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SIR REGINALD SPENCE, Kt., M.L.C., J.P., S. H. PRATER, C.M.Z.S., M.L.C., J.P.
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ERRATA

Vol. XXXV, No. 1.

(THE BUTTERFLIES OF COORG. PART II.)

ADDENDUM.

459. 5a. **Pratapa deva deva,** M.

I had set aside a ♀, which was neither **Tajuria jehana,** M. ♀ nor **Tajuria cippus cippus** F. ♀

Recently Capt. Riley of the British Museum identified it as **Pratapa deva deva,** M. I saw and took no other; this I took in an opening in a patch of thick wood by a stream at Kolakeri near Napoklu in Coorg.

CORRIGENDUM.

For I 32. 1a **Caprona ransonnetti potiphera,** Hew. *read* 'I 26. 1. a **Caprona ransonnetti ransonetti,** Fd.'

γ. **Caprona ransonnetti taylorii,** DeN.

Both forms occur. Oddly enough the only Bangalore specimen I have, appears to be the rare **Caprona ransonnetti lanka,** nov. (Evans), but it is a rainy season specimen, taken in July.

The references I give are to Evans' *Identification of Indian Butterflies*, 2nd Edition.

Vol. XXXV, No. 4.

Page 916, Misc. Note XXXIV, last line, instead of **Helianthus licaberimmus** *read* '**Helianthus scaberimmus.**'

Vol. XXXVI, Nos. 1 & 2.

Page 252. Misc. Note No. XIII, line 8 from bottom. Instead of 'No chital are recorded as shot since 1914.' *read* 'No "chital" are recorded as shot prior to 1914–15, the figures being tabled under "Spotted Deer."'

Page 332, line 13. Instead of 'gouge' *read* 'gong.'

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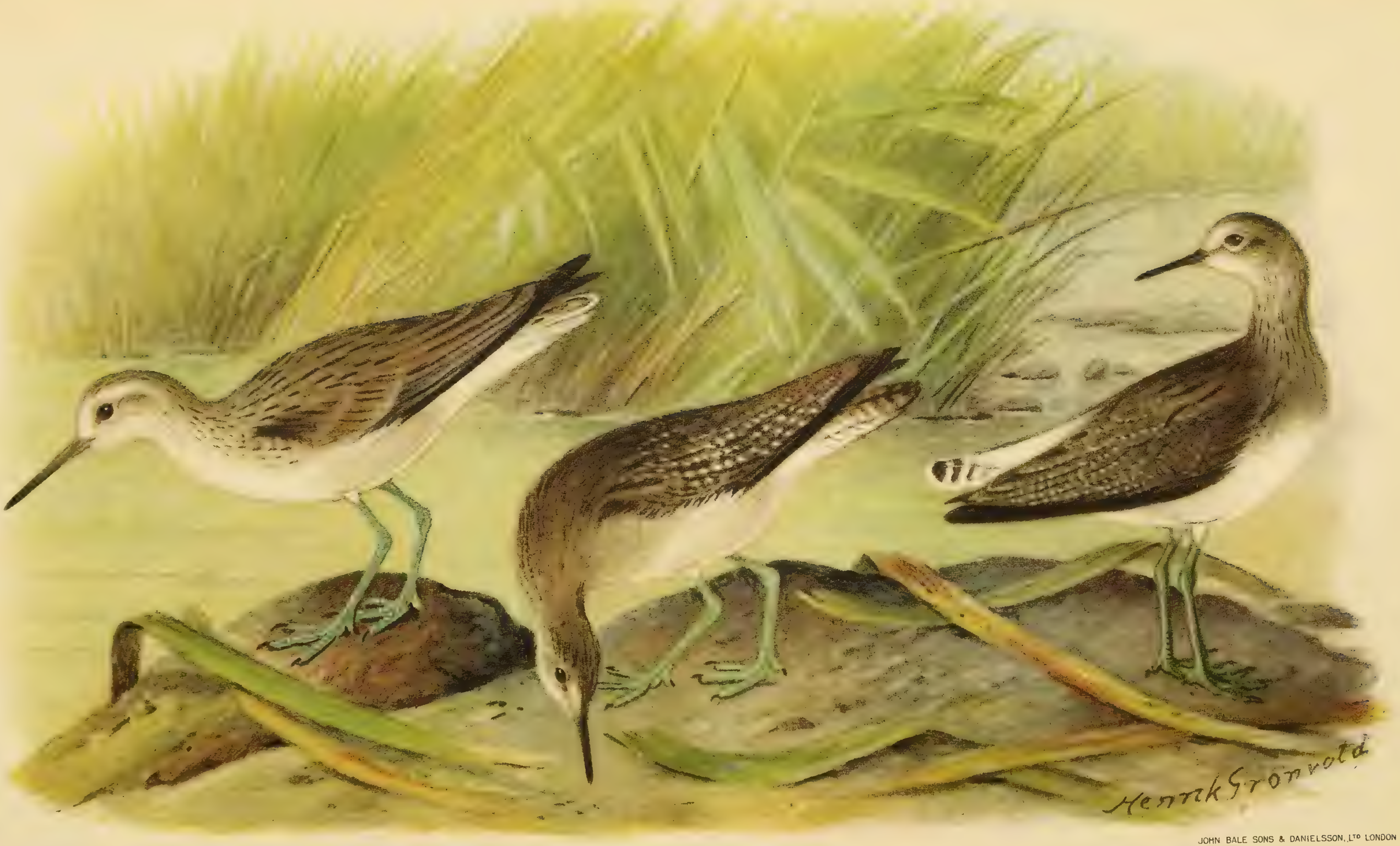

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Marsh Sandpiper 1/3
Tringa stagnatilis

Wood Sandpiper 1/3
Tringa glareola.

Green Sandpiper 1/3
Tringa ochrophus.

JOURNAL

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NOVEMBER 1932. VOL. XXXVI. NO. 1.

THE GAME BIRDS OF THE INDIAN EMPIRE.

BY

E. C. STUART BAKER, C.I.E., F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

VOL. V.

THE WADERS AND OTHER SEMI-SPORTING BIRDS.

PART XVIII.

(*With a coloured plate*).

(*Continued from page 721 of Volume XXXV*).

FAMILY: SCOLOPACIDÆ.

Genus: Tringa.

Tringa.—Linn., Syst. Nat., 10th. ed., i. p. 148 (1758).
Type by desig.—*Tringa ochrophus* Linn.

Blanford included in this genus, which he called *Totanus* instead of *Tringa*, eight species of Sandpiper, but these have been separated by other systematists until practically every species has been relegated at one time or another to a genus of its own. This system seems to defeat the very purpose of classification which has created the term genus for a *group of species* which are nearer to one another than to others which should be placed in other groups. Occasionally a single species may be so aberrant as to deserve recognition by generic separation but this should be exceptional. In the present instance the only birds I separate are the two large Amstrong's Sandpipers:—Birds with upturned bills and with large webs between the outer and middle toe and practically none between the middle and inner—and the Greenshank, which I include in the genus *Glottis*, now generally recognised, though possibly without sufficient reason.

In the genus *Tringa* the bill is long, slender and straight; both mandibles are grooved, the oval nostril being placed near the base of the bill; the tip of the upper mandible is hard and bent down; the tarsus is about the same in length as the culmen or slightly longer or shorter; it is scutellated in front and behind; the hind toe is present; the outer toe is joined to the middle by a web and the inner and middle have a smaller web between them, sometimes almost obsolete.

There is little difference between the breeding and non-breeding plumage, except in *Tringa erythropus* (*fuscus* auct.) which has a very dark breeding dress.

As restricted in this work, the genus *Tringa* contains six Indian species; outside our area it is practically cosmopolitan.

Key to Species.

A. Legs olive-green or yellowish-green, never red.	
a. Intermediate in size, wing from 130 to 150 mm.	
a'. Lower back brown; tarsus a little shorter than culmen ...	*T. ochrophus*, p. 215[1].
b'. Lower back white; tarsus a little longer than culmen ...	*T. stagnatilis*, p. 216.
b. Smallest in size; wing from 93 to 128 mm.	
c'. No white on rump	*T. hypoleucos*, p. 217.
d'. Rump white	*T. glareola*, p. 219.
B. Legs red. Largest in size:	
c. Outer secondaries all white ...	*T. totanus*, p. 221.
d. Outer secondaries barred brown and white	*T. erythropus*, p. 223.

TRINGA OCHROPHUS.

The Green Sandpiper.

Tringa ochrophus.—Linn., Syst. Nat., 10th. ed., i, p. 149 (1758) (Sweden); Stuart Baker, Fauna of British India, vi, p. 215 (1929).

Totanus ochropus.—Blanf. & Oates, iv, p. 262.

Vernacular Names.—*Nelia ulanka* (Tel.).

Description: *Breeding plumage.*—Upper part and sides of head, back and sides of neck brown, each feather edged with white; mantle brown with a bronze-green gloss, spotted with white, some of the scapulars with blackish-marks between the white spots; lower back and rump blackish-brown with narrow white fringes; upper tail-coverts white; tail with the concealed base white, the rest barred black and white; innermost wing-coverts and secondaries like the back; other coverts brown with the same gloss as the back; remaining wing-quills dark brown; chin, throat and whole underparts white, the fore-neck, breast and flanks streaked and barred with dark brown.

Colours of soft parts.—Iris brown; bill dull greenish, black at the tip; legs and feet dull greenish-brown or olive-green.

Measurements.—Wing, ♂ 135 to 150 mm., ♀ 141 to 154 mm.; tail 54 to 60 mm.; tarsus 32 to 33 mm.; culmen 33 to 36 mm.

In Winter the head and hind-neck are uniform brown, sometimes with a greyish tinge; the spots on the back are smaller and very inconspicuous whilst, generally, the upper head is more grey-brown with less developed streaks.

---

[1] The page numbers to the *Fauna of British India*, second edition.

Young birds in the first moult have narrow bronze margins to the feathers of the upper parts; the bands on the base of the tail are narrower and the terminal band broader.

Nestling.—Above deep cinnamon-pink, crown and a line from the bill black, the crown mottled with cinnamon; a black dorsal line from nape to tail-tuft; two lateral black bands on each side of this; a second lateral black line across the wings and from these all round the uropygium; upper breast cinnamon; remaining underparts white.

Distribution.—Throughout Northern Europe and Asia in the breeding season and migrating south in Winter to Africa, India, China, the Indo-Chinese countries and Malaya.

Nidification.—The Green Sandpiper breeds in the southern portions of the Baltic States and in northern Germany from the end of April to May, whilst in the extreme northern portions of its range eggs may be found from early June to early July. This little Sandpiper has the habit of depositing its eggs in the nests of other birds, generally those of the Redwing or Fieldfare of the previous year. Among the first to obtain its eggs was Herr Pässler, who recorded the fact in 'Normannia' for 1851. At the time he believed the egg to be that of the Wood-Sandpiper, correcting his mistake in the following year, 1852. Prior to this, however, eggs had been taken by a forester in 1845 and given to Herr Wiess, who refused to believe in their authenticity. In 1846, however, he himself found a nest, presumably that of a thrush, with four eggs of this Sandpiper, in a pine tree some 25 or 30 feet from the ground. In 1856 other eggs were taken by Dr. Altum and in 'Normannia' for that year is a paper by a forester, Hintz, describing the taking of still other eggs and adding that he had already found this bird breeding in old nests of the Song Thrush. This paper referred to Western Pomerania. In the *Ibis* for '59 a further record of this bird's breeding was given. Since then a great many eggs have been taken and these nearly always from nests but there are one or two records of the bird breeding on the ground in grass or marsh land in a manner very similar to that of the Wood-Sandpiper. As already stated, the nest generally selected is one of some species of thrush, probably more often a fieldfare than any other, but Wheelwright in his 'Ten Years in Sweden' says that they sometimes lay in a deserted nest of a squirrel, jay, or crow and, sometimes, in *new* thrushes' nests, the proper owners having been driven away. The site selected is often one at a considerable distance from water, occasionally indeed, far away even from swamp or marsh land. The nest selected may be anything from 10 to 20 feet from the ground; on the other hand there are records of its eggs having been taken from nests as high as 40 feet up. They are said invariably to select nests in fir-trees but there are certainly exceptions to this rule, for I have myself records of eggs taken from a redwing's nest placed quite low down in a birch-tree, and of another set of eggs taken from a broken down brambling's nest placed in a birch about

DEC 30 1932

8 feet from the ground. This is the only record, however, of a brambling's nest being used and such a choice must be most exceptional.

The hen bird is said to sit very close, but to slip quietly off the nest when disturbed, slinking away amongst the trees so that it is not always easy to spot her. If suddenly surprised, however, she will sometimes get off the nest and fly straight into the air, where, after mounting to a good height, she twists and turns rapidly, much like the Broad-billed Sandpiper. The cock bird, which probably also shares in the duties of incubation—at all events during the night—has a very sweet little trilling lovesong, accompanied by a quick dipping flight as the bird moves round in circles. Occasionally, however, he will sing to his mate perched on a bare twig at the extreme top of some tree in the vicinity of the nest. The eggs are, as one would expect, always four in number. The ground colour varies between pale-yellowish or greenish-stone, and a rather more deep yellowish-buff. The primary markings generally consist of rather small specks and spots of a dark reddish-brown, occasionally interspersed with others of a rather lighter hue. The secondary markings are tiny spots of lavender or neutral tint. Compared with most Waders' eggs they are pale and poorly marked, it being very exceptional to find an egg in which the markings are of any size or richness in colour, though one set in the Wolley Collection in Cambridge, is almost as handsomely marked as eggs of the Marsh-Sandpiper. A hundred eggs average 39.0 × 27.9 mm., maxima *42.0* × 28.0 mm. and 41.1 × *30.3* mm.; minima *34.6* × 26.0 mm. and 34.8 × *25.5* mm. The period for incubation is supposed to be 18 days but there is very little information on this point.

Habits.—This little Sandpiper is one of our most common winter visitors over the whole of northern India and Burma, though as it wanders south it becomes less numerous. It has, however, been recorded from Ceylon and from south of the Malay Peninsula. It is also one of our earliest arrivals, as I have personal records of its appearance in Assam on the 10th., 12th., and 13th. of August, when it was observed feeding in some numbers in marshes in the Brahmapootra Valley in the district of Dibrugarh. In the Surrma Valley, to the south of Assam, it arrives at about the same time; my earliest record being the 6th. of August, when a pair was seen feeding on the edge of a small stream in North Cachar. When the birds first appear in India they may be seen in comparatively large flocks, sometimes as many as fifty or sixty: these seem, however, to break up immediately and the birds disperse at once in small parties of half a dozen or so, or in pairs or singly.

It is a very quick, active little bird, running rapidly here and there after the insects upon which it principally feeds, or probing in the shallow mud for tiny crustacea and small worms. One summer we noticed them on a lotus-covered swamp, feeding on the tiny little water snails which were to be found on the lily leaves in great numbers. One bird which I shot contained nothing but a mass of these water snails. Walking on the lily leaves, their actions seemed to be much more deliberate than when they were running about on the shore, probably because they had to search carefully for the tiny snails which were generally hidden in the rim of the leaves.

When not tired, it is a shy little bird and does not often allow a very close approach, but takes to flight, mounting quickly into the air, twisting and turning as it mounts, and then flying directly away at great speed. In India the only note that will be heard is a musical little whistle of three syllables, sounding like 'Twi, twi, twi'. The Green Sandpiper can hardly claim to be called a sporting bird. At the same time its flesh is by no means to be despised.

Tringa stagnatilis.

The Marsh-Sandpiper.

Totanus stagnatilis.—Bechstein, Orn. Tasch., 2, p. 292 (1803) (Germany); Blanf. and Oates, iv, p. 263.

Tringa stagnatilis.—Stuart Baker, Fauna of British India, vol. vi, p. 216 (1929).

Vernacular Names.—*Chota Gotra* (Beng.).

Description: *Breeding plumage.*—Lores whitish; upper part of the head, neck and upper back sandy-grey, becoming a little browner on the inner secondaries and inner wing-coverts; head and neck streaked with black, the streaks becoming broader on the mantle and changing to broken bars on the scapulars and inner secondaries, the longest of which have 'herring-bone' markings of black; lower back and rump white; tail pale-brown, greyer at the base, with narrow bars of blackish, then decreasing outwardly until the outermost feathers merely have two narrow longitudinal lines of dark brown; primaries and outer secondaries dark brown, the latter tinged with grey and both with the inner web speckled with white and brown on two-thirds of their length; primary coverts and edge of wing black; median and secondary coverts brown-grey, narrowly edged with white; lower plumage white, the sides of the neck and head, fore-neck, breast and flanks spotted with black, the spots becoming bars on the sides of the lower breast and the flanks.

Colours of soft parts.—Iris brown; bill dark horny-brown to blackish, the base of the lower mandible paler and greenish; legs and feet dull sage-green, olive-green or bluish-green.

Measurements.—Wing, ♂ 131 to 138 mm., ♀ 133 to 143 mm.; tail 56 to 66 mm.; tarsus 48 to 58 mm.; culmen, ♂ 36 to 39 mm., ♂ 40 to 45 mm. The supposed form *horsfieldi* is not any smaller than typical *glareola* and cannot possibly be separated.

In Non-breeding plumage the forehead, short supercilium, sides of the head and lower plumage are unspotted white; the upper surface is much darker and browner, the shafts showing just a trifle darker, whilst the hinder crown and neck nearly always show a few dark streaks; the sides of the upper breast are generally more or less marked with brown.

Distribution.—South-Eastern France, South Russia and the

Southern Baltic Provinces and Western Asia to Central South Siberia and Turkestan, Dauria and east to Mongolia. In Winter it migrates south to Africa, Palestine, Arabia, India, Burma, Malaya, South China and Australia.

Nidification.—The Marsh-Sandpiper breeds in Southern Russia and the Southern Baltic States to Western Asia as far as Turkestan and Dauria, whence it is said to spread as far as Mongolia. At one time it was perhaps more common in Hungary than anywhere else but so many of its breeding haunts have been drained and reclaimed that it has become a very scarce breeding bird in that country. In Poland, I am told, it is still common on the Pinsk Marshes but these cover such an immense area of country that unless one knows the habits of the birds very well, it is rather like hunting for the proverbial needle in the haystack. Eggs have been taken in the last week of April and from then to the first or second week in June, whilst one set, probably a second laying, has been recorded as being taken on the 8th of July. The nest is a typical Sandpiper's—some natural hollow in among thick short grass on the edges of swamps and marshes. It is said to be generally well lined with grass and to be well hidden, the bird sitting very close and, if the eggs are at all incubated, refusing to move until she is almost stumbled upon. On leaving the nest her actions are very similar to those of the Dunlin. Sometimes she will tumble off the nest and with dragging wings stagger across the ground in an attempt to lead the intruder away from the nest. At other times she will flick off the nest exactly as the Dunlin so often does, jumping straight into the air with extraordinary rapidity and then, after two quick zigzags, fly straight away. Occasionally the nest may be less well concealed than usual on a small hummock in the centre of deep swampy ground, but such a site seems to be quite an exception.

The eggs, as usual, are four in number and decidedly handsome and densely marked, even for those of a wader. The ground colour varies from a pale stone or fawn to a comparatively deep buff, but, though pinkish eggs are not rare, a green tint seems to be very exceptional. Primary markings are bold blotches and smaller marks of chocolate brown or blackish, scattered profusely over the whole egg and generally still more dense at the larger end. The secondary markings are a pale neutral tint, frequently with a distinct tinge of pink. Forty-eight eggs average 38·5 × 27·1 mm.

Whether the male bird assists in incubation or not, there seems to be no record, but it is said generally to keep somewhere close to the nest while the hen bird is sitting.

Habits.—The Marsh-Sandpiper is found in winter over the whole of India and Burma, extending into Africa, South China and even as far as Australia, whilst it has been recorded from many of the islands of the Australasian area. It is a bird more addicted to inland lakes and swamps than to the seashore and, though not nearly so numerous as the Green Sandpiper, may be generally found wherever there is sufficient marsh land to suit its purpose. In its actions it is very much the same as other small birds of the genus, running rapidly about in shallow mud or short grass, feeding on insects, worms, *coleoptera* and tiny *crustacea.*

This little bird is one of our disturbing factors in determining the genera into which the Sandpipers should be split. For one thing, instead of having a perfectly straight bill, it curves very slightly upwards, although the curve is so slight that it is hardly noticeable and in dried bills may not be visible at all. In this characteristic it rather approaches birds of the genus *Glottis* and perhaps would justify the classification of some authors by whom they are placed all together in one genus.

Like all Sandpipers, it is not a bad little bird to eat, if one has not much choice, though it would take a great many to make a meal. I remember, however, once out in camp about a dozen or more Marsh and Green Sandpipers were caught in nets by the Mahomedan wildfowlers and handed over to me for two annas. I made the skins I wanted as specimens and found the remainder cooked in a pie were really delicious. Those birds, of both species, had been feeding on very small ivory-white worm, apparently probed out of the mud.

TRINGA HYPOLEUCOS.

The Common Sandpiper.

Tringa hypoleucos.—Linn., Syst. Nat., 10th ed., i, p. 149 (1758) (Sweden); Stuart Baker, Fauna of British India, vol. vi, p. 217 (1929).

Totanus hypoleucus.—Blanf. and Oates, iv, p. 260.

Vernacular Names.—*Polte ulanka* (Tel.); *Kotan* (Tam.).

Description.—Whole upper parts and tail brown faintly tinged with olive; the feathers from the forehead to the lower back with fine dark central streaks, broadest on the back and scapulars; feathers from lower back to upper tail-coverts, scapulars, inner secondaries and wing-coverts with narrow pale rufous edges and sub-edges of black, most conspicuous on the wing-coverts; central tail-feathers like the back, outer tail-feathers barred black and white, intermediate tail-feathers intermediate in colour; primaries brown, the first white-shafted, the third and following primaries with a patch of white on the inner web; outer secondaries white, the outermost with broad subterminal blackish bands, disappearing on the central feathers; inner secondaries like the back; greater coverts dark brown, tipped with white and the outer edged with white also; chin and throat white; fore-neck and upper breast white with dark streaks and some brown on the sides of the breast; axillaries and remainder of lower plumage white.

Colours of soft parts.—Iris brown; bill horny-brown or grey-brown, darker at the tip; legs and feet pale dull green.

Measurements.—Wing 99 to 119 mm.; tail 50 to 58 mm.; tarsus about 22 to 25 mm.; culmen 23 to 26 mm. Extreme Western birds have a wing 99 to 112 mm.; extreme Eastern 102 to 111 mm.

In Winter the upper surface is more uniform, the head and hind-neck often immaculate; the general tint is also rather more olive.

Nestling in down.—Upper parts darkish cinnamon buff; a line from the upper mandible and the crown blackish and a black line through the eyes meeting behind the crown; centre of nape blackish owing to the black bases of the down showing through the buff tips; a black dorsal line from nape to uropygium; two fainter lateral bands on the sides of the back and black bands on the wings; lower plumage white, the breast suffused with buff.

Distribution.—Breeding throughout the greater part of Europe to Western Siberia and thence east to Japan and south to Kashmir and Tibet. Mathews accepts *T. h. aurita*[1] as a good race on the grounds that it is smaller and paler. I can find no difference in the size of this little wader in any special geographical area, nor can I see that Eastern birds are any paler than Western; I therefore consider *aurita* to be merely a synonym of *hypoleucos*.

Nidification.—The Common Sandpiper breeds within our limits all along the Himalayas at altitudes between 9,000 and 12,000 feet and less frequently as low as 5,000 feet. South of the Himalayas the only record of its breeding is that of Scrope Doeg, who records finding a nest in the Eastern Narra, Sind on the 3rd of July. I have not been able to find these eggs anywhere and the authenticity of this record is very doubtful. In Kashmir they are very common, breeding for the most part in May and June within a short distance of, or actually on, the banks of the streams and rivers. Hume records their laying their eggs in mere depressions in the shingle or sand, without lining or with only a little lining of grass, quite unconcealed. As a matter of fact, however, the great majority of nests are well hidden, generally in fairly thick grass or low scrub, under some boulder or in amongst masses of stones. In most cases also, there is either a good lining of grass and leaves, or the grass itself is so beaten down as to form a warm comfortable bed. The earliest record I have for eggs is a set taken on the 9th. of May by Mr. S. L. Whymper at Harsil in the Garhwal Hills, which were found laid in a depression in a shingle bank of the Bhaghiratti River. The latest date I have is the 8th of August—four fresh eggs taken by A. E. Ward's collector on the Sind River. Sometimes this Sandpiper makes its nest at some considerable distance away from the bigger rivers and streams and Col. Buchanan informed me that he took several nests in Kashmir in a well-wooded ravine, where they were cleverly concealed amongst bushes or completely hidden under some boulder or overhanging bank. At the bottom of the ravine there was generally a certain amount of water trickling down, drainage from the surrounding high ground. Normally the eggs number four, as with all other waders, but Col. K. Buchanan had a curious experience with this bird in Kashmir in 1907. In a letter to me he writes:—

'I did not know that there was anything strange in this bird's (Common Sandpiper) laying 5 or 6 eggs. It is never a rare bird in Kashmir but this year in Pahlgaon it was extraordinarily common and I took many nests. Three of these contained 6 eggs and there were several with 5 although of course the great majority had only 4. The nests and eggs were always very well hidden or I should doubtless have found many more. I took nests from the third week in May to the end of June.'

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[1] *Tringa aurita* Latham, Ind. Orn., Suppl., p. lxvi (1801) (Java).

In ground colour the eggs vary from pale creamy-buff or yellowish-stone colour to a warm-buff or reddish-buff. Normally they are fairly profusely spotted, especially at the larger end, with small spots, blotches and specks of reddish-brown and umber-brown, with others still smaller and less conspicuous of pale-grey or pinkish-grey underlying them. Rarely the blotches are somewhat bolder and larger but, taking the eggs as a series, they are not so handsomely marked as most Waders' and a really bold, handsomely marked clutch is exceptional. I have seen Indian clutches in which the markings consist of twisted lines interspersed with a few bold blotches, the majority of these markings, as is generally the case, being confined to the larger end. Eggs almost or entirely without markings are occasionally found but less often in this species than in some of the other Waders, such as the Ringed Plover.

A hundred Indian eggs average 35.6 × 26.2 mm.; maxima *30.9* × 26.9 mm., and 35.5 × *27.2* mm.; minima *32.1* × 26.3 mm., and 32.2 × *24.1* mm. Jourdain gives the average of a hundred British eggs as 36.4 × 25.9 mm.

Outside our Indian limits the Common Sandpiper breeds over the greater part of Northern Europe and Asia from Great Britain to Japan, eggs being laid from early May to mid June over the Southern portion and in late June in the area nearer or inside the Arctic Circle. In Lapland we found quite fresh eggs late in June but, on the other hand, we found one nest with four eggs on the point of hatching on the third of that month, and these eggs must have been laid during a time of heavy frost and snow. The bird is a close sitter and both parents take a share in incubation, though this is said to be carried on chiefly by the female. In India, however, the male certainly takes its fair share, as among birds trapped on the nest, I have a record of four males to three females. Perhaps this is due to the fact that most of my birds were noosed on their nests during the night and it may be that, while the female incubates during the day, the male takes over her duties after sunset. Incubation is said to take 21 to 23 days in Europe but the only record I have in regard to India was for 20 days only, dated from the laying of the last egg.

Habits.—The Common Sandpiper occurs in great numbers over the whole of India during the winter and, according to Wait, is equally common throughout the low country of Ceylon, wandering up in smaller numbers as high as Nuwara Eliya. It is equally abundant on rivers and marshes inland as it is on the seashore during the winter, where it may be seen either singly, in pairs or in small flocks, running about hunting for its food, which consists of all sorts of insects, fresh water mollusca, worms, beetles, etc. It is a very restless little bird and seems to be constantly on the move, alternating a number of little runs with a short flight in the air, after which it returns to its original position. It is an easy bird to distinguish on the wing, having its lower back and uppertail coverts all brown, a feature which distinguishes it at a glance from all the other small Sandpipers of about the same size. Further, the broad white bar across the whole upper surface of the extended wing is a conspicuous help to identification. Its ordinary cry during the cold weather is a sharp but rather pleasant 'Twit-twit', uttered by the bird as it takes to wing and less often, in flight. During the breeding season it has a very sweet trill which Witherby syllabifies as 'Kitty-needie, kitty-needie, kitty-needie'; the bird sings these notes as it flies round in wide circles, ascending and descending with outstretched quivering wings. Like most of the Waders, when disturbed from its nest, the Common Sandpiper goes through all sorts of contortions, as if wounded or ill, in an endeavour to entice the intruder from its nest. This little bird is quite good eating but the flesh is rather dry.

TRINGA GLAREOLA.

The Wood-Sandpiper.

Tringa glareola.—Linn., Syst., Nat., 10th. ed., i, p. 149 (1758) (Sweden); Stuart Baker, Fauna of British India, vi. p. 215 (1929).

Totanus glareola.—Blanf. and Oates, iv. p. 261.

Vernacular Names.—*Chupka, Chobaha, Tutwari* (Hind.); *Chinna ulanka* (Tel.)

Description: *Breeding plumage.*—A narrow supercilium and round the eye white; a streak through the eye brown; upper plumage very dark brown, the feathers of the crown and hind-neck streaked with white; elsewhere spotted with white on the edges of the feathers, narrowly edged at the tip with whitish and with the terminal portion almost black; upper tail-coverts white, a few of the longest sometimes streaked with brown; tail banded dark brown and white, the brown in excess on the central, the white on the outermost feathers; primaries, primary coverts and greater coverts blackish; outer secondaries and their coverts lighter brown, with very fine edges of white soon lost by abrasion; sides of head and neck white, spotted and streaked with dark brown; chin and throat immaculate white; breast and flanks white, profusely spotted and barred with brown; remainder of lower parts white, the axillaries barred and the under tail-coverts streaked and barred with brown.

Colours of soft parts.—Iris hazel to dark brown; bill blackish; the base paler horny-green; legs and feet pale sage-green or olive-green.

Measurements.—Wing 117 to 125 mm.; tail 45 to 50 mm.; tarsus 36 to 41 mm.; culmen 26·5 to 30 mm. The sexes are alike in size.

In Non-breeding plumage the white spots and black markings are not so well-defined; the fore-neck and breast are a sullied pale brown, indistinctly streaked with darker.

Nestling.—Upper parts pale cinnamon-pink. A broad black coronal streak from the upper mandible to the back of the crown; the posterior portion stippled with cinnamon; nape and uropygium tuft dusky-blackish-brown stippled with pink; a black line through the eye to the nape; two blackish-brown lines on either side under the wings and on either side of the rump; a patch of the same round the uropygium tuft and another patch not quite so dark round the tibia. Under parts white, the down on the breast tipped with cinnamon.

Distribution.—Breeding throughout Sub-Arctic and Northern Europe and Asia and wintering in Northern Africa, all India and Southern China, through the Australasian Islands to Australia.

Nidification.—The Wood-Sandpiper does not breed within Indian limits but I have found many of its nests in Finland and Lapland, where it lays from the middle of May until the end of June. I know of no nest of any small Wader which is so difficult to find as that of this one. Its breeding haunts are confined within the northern limit of the birch forest, its occurrence outside this being very exceptional. Its favourite haunt seems to be some swamp in which there is deep and treacherous mud, overgrown with dense undergrowth of tangled dwarf birch, juniper and thick coarse grass, amongst both stunted pine trees and dwarf birches, growing in less or greater profusion. Here on some hammock or small dry patch, the bird places its nest, so well concealed that until the bird rises from it and one parts the vegetation, it is impossible to get a glimpse of the eggs. The hen bird sits extraordinarily close and even before the full complement of eggs are laid will often refuse to take wing until the intruder is within a foot or two of her. The cock bird is really the easiest guide to the nest, for its beautiful little song is constantly uttered within a very short distance of it; generally it is uttered as he soars round immediately overhead, or crosses and recrosses over it in short dipping flights. Sometimes, however, he will perch on a bare twig of a fir-tree and sing to his wife from that vantage point. Once having located the male, one may be pretty sure that the nest is within a couple of hundred yards or less of where he sits, after which, a continuous careful search, yard by yard, may possibly bring it to light. Some nests, however, are so carefully hidden as absolutely to defy detection. In Northern Lapland, on three days running, I disturbed a Wood-Sandpiper from her nest evidently placed somewhere under masses of birch branches cut by the Lapps the previous summer and left lying where they had fallen. After the third time I had put her up and made a fruitless search, I then twice came out to hunt for her in the middle of the night and, though on each occasion I put her up within ten yards of me, I left Lapland without having discovered the nest.

The nest itself is generally made in a little whorl of grass, or other vegetation, the ends completely bent over it in a twisted circle, so that even when the bird is suddenly frightened into leaving the nest, the eggs are still completely covered. Unless the ground is very wet, there seems to be no true lining, though the beaten-down grass and fallen birch leaves form a soft bed for the eggs to lie on. The eggs of course number four as usual, but they vary very greatly in colour; those in my own series, which include a large number taken by Wolley in Finland, have the ground colour most often a pale ochre yellow or pale buff but others have it distinctly greenish or greyish. In others again, it is a distinct pinky buff. The markings consist of small blotches and spots, reddish brown and blackish brown, generally fairly bold and almost always more numerous at the larger end than elsewhere, and forming sometimes an indefinite ring or cap. The eggs are decidedly handsome, far more so than those of the preceding bird, the markings being much bolder and standing out more decidedly from the ground colour. A hundred eggs average 38·3 × 26·4 mm. and Jourdain gives the following figures:—

Maxima *42·0* × 28.1 mm. and 41·5 × *28.5* mm.; minima *35·5* × 25.0 mm. and 37.0 × *24·4* mm. Incubation according to the Finns is said to take 16 or 17 days.

Habits.—Among the many common Waders which are found in India throughout the cold weather, there are none more numerous than the present bird. They are also amongst the earliest arrivals, the first few birds appearing early in August, and great numbers before the end of that month. Soon after their arrival, which occurs in flocks of considerable size, they wander all over India, arriving in Ceylon, where they are common, about the middle of September. Arriving earlier, they also leave later than most of our Waders. A few remain in Ceylon and Southern India until about the middle of April, whilst in Northern India a few birds may still be seen the last week in May. Over the greater part of its area, it seems to be equally common both on the seashore, the mouths of tidal rivers and the great marshes found everywhere inland. They are not however confined to these, and pairs or single birds may be seen by small pools and ponds and even on the banks of hill streams. According to Wait, however, in Ceylon it keeps generally to the salt marshes, tidal flats, and the low shores round lagoons. In Southern India also, both on the West and East, it appears to be entirely a bird of the seashore and is comparatively seldom found in the flooded rice fields.

As regards their habits, it is difficult to find anything of especial note differing from other Sandpipers. It has the same strenuous activity, both on the wing and on foot, whilst its food consists of the same items as those of the birds already dealt with. During the cold weather the only note they utter is a shrill little piping cry but, as already described, the breeding song is really very fascinating. Such small birds are not worth shooting for the pot, even when a man is on the outskirts of civilization and finds it hard to get anything to vary his diet, but the flesh is quite palatable and when the birds are fat, as they generally are, not too dry.

(*To be continued.*)

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY.

BY

E. BLATTER, S.J., Ph.D., F.L.S.

PART XIX.

(With 9 plates.)

(Continued from page 736 of Volume XXXV).

ORCHIDACEAE.

BY

E. BLATTER, S.J., Ph.D., F.L.S. & C. MCCANN, F.L.S.

37. HABENARIA Willd.

Species about 500.—Temperate and tropical countries.

Cooke mentions 17 species from the Bombay Presidency. Of these *H. subpubens* is being reduced and united with *H. Heyneana*. *H. digitata* as conceived by Cooke is split up into *H. digitata* Lindl. and *H. Gibsoni;* the variety *foliosa* is restored to the rank of a species. Sedgwick has described a new species: *H. multicaudata* and we add 5 new ones: *H. Spencei*, *H. grandifloriformis*, *H. variabilis*, *H. cerea* and *H. Hallbergii*, and one new to the Presidency, *H. ovalifolia*.

Key based on Cooke:

- A. Petals 2-partite. Lip 3-lobed or 3-partite
  - I. Sepals with filiform tips ... ... 1. *H. stenopetala.*
  - II. Sepals not filiform at the tips
    - 1. Lower segment of petals shorter than the upper
      - a. Petals bipartite nearly to the base ... 2. *H. digitata.*
      - b. Petals deeply 2-cleft ... ... 3. *H. foliosa.*
    - 2. Segments of petals subequal ... ... 4. *H. Gibsoni.*
    - 3. Lower segment of petal longer than the upper
      - a. Leaves more than one, not roundish
        - * Lobes of lip filiform, fantastically contorted ... ... 5. *H. multicaudata.*
        - ** Lobes of lip linear ... ... 6. *H. Spencei.*
        - *** Lobes of lip: lateral filiform, longer than the broader linear obtuse midlobe ... ... 7. *H. rariflora.*
      - b. Leaves 1 or 2, both or at least the lower roundish
        - * Lip 22 mm. long ... ... 8. *H. grandifloriformis*
        - ** Lip 12 mm. long ... ... 9. *H. grandiflora.*
- B. Petals entire
  - I. Side lobes of lip broader than the midlobe
    - 1. Lip deeply 3-lobed or 3-partite, not or hardly longer than the lateral sepals
      - a. Side lobes of lip small, rounded ... 10. *H. platyphylla.*
      - b. Side lobes of lip large, obliquely truncate and denticulate at apex ... 11. *H. suaveolens.*
    - 2. Lip deeply 3-lobed or 3-partite, much longer than the lateral sepals
      - a. Lobes of lip not tailed
        - * Spur 11 mm. long, lateral sepals 14 mm. long ... ... 12. *H. variabilis.*
        - ** Spur reaching 10 cm. long, lateral sepals 12 mm. long ... ... 13. *H. longicalcarata.*
        - *** Spur 3 cm. long, lateral sepals 5 mm. long ... ... 14. *H. plantaginea.*
      - b. Lobes of lip with long filiform tails ... 15. *H. crinifera.*

II. Side lobes of lip not broader than the midlobe
1. Tubes of the anther-cells long ... 16. *H. commelinifolia.*
2. Tubes of the anther-cells short
a. Stem leafy upwards
* Bracts much shorter than the flowers 17. *H. cerea.*
** Bracts exceeding the flowers ... 18. *H. Heyneana.*
b. Leaves 3-6, clustered towards the middle or at the base of the stem
* Bracts as long as or longer than the ovary
† Leaves green throughout, placed near the middle of the stem
¶ Side lobes of lip narrow, longer than the linear obtuse midlobe 19. *H. affinis.*
¶¶ Side lobes linear-oblong, incurved, as long as or shorter than the ovate-oblong fleshy midlobe ... ... 20. *H. ovalifolia.*
†† Leaves placed near the base of the stem
§ Leaves with narrow yellowish margins ... ... 21. *H. marginata.*
§§ Leaves without yellowish margins ... ... 22. *H. Hallbergii.*
** Bracts much shorter than the ovary, leaves placed near the base of stem ... ... 23. *H. viridiflora.*
c. Leaves 2 (rarely 3), radical or opposite on the stem, broadly ovate or suborbicular, cordate at the base
* Bracts 12-18 mm. long; lateral lobes of lip shorter than the midlobe ... 24. *H. crassifolia.*
** Bracts 6 mm. long; lateral lobes of lip longer than the midlobe ... 25. *H. diphylla.*

1. **Habenaria stenopetala** Lindl. Gen. & Sp. Orchid. (1835) 319 (*nor* 324); Hook. f. F.B.I. vi, 134; King & Pantl. in Ann. Roy. Bot. Gard. Calc. iii (1898) 308, t. 404; Cke. ii, 715 (*excl. Hab. modesta* Dalz.).

Cooke doubtfully gives as synonym: *Habenaria modesta* Dalz. in Kew Journ, Bot. ii (1850) 262, and cites in addition Dalz. & Gibs. 267. Dalzell's plant is quite a different species, very likely *Peristylus stenostachyus* Kränzl. The stem is leafy at the base and naked above. The bracts are half as long as the ovary, flowers greenish white, lip 3-fid, lateral divisions linear-lanceolate, free spreading, midone shorter ovate obtuse, cohering with the tips of the petals and upper sepal, and concealing the column, spur filiform, hardly clavate, a little longer than the ovary.

Description: Cke. ii, 715.—A very variable plant.

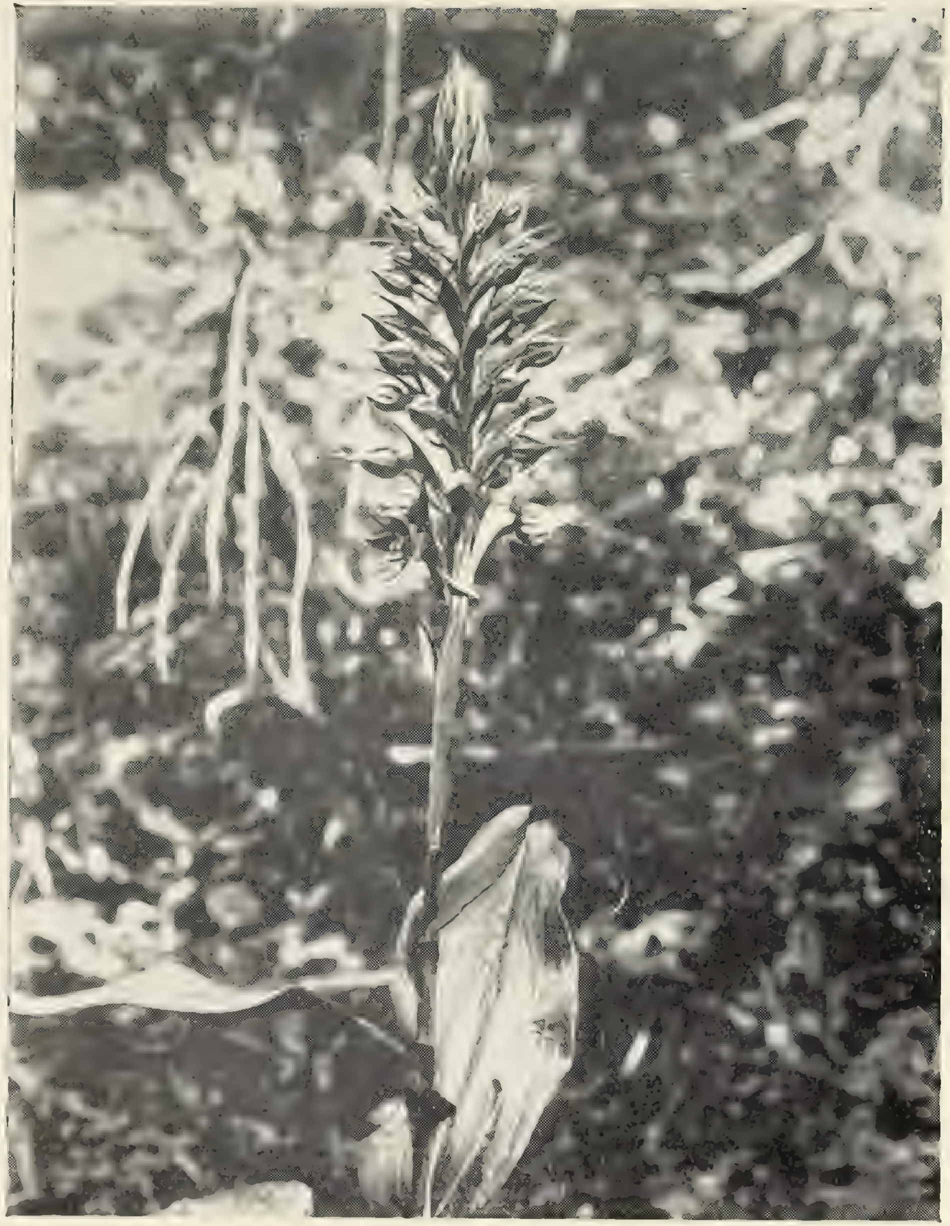
Locality: *Konkan* (Stocks).—*W. Ghats*: Parva Ghat (Dalzell 15); Londa (Spooner !);—*N. Kanara*: Forests, without precise locality (Bell 5404 !).

Distribution: N.-W. India, Sikkim Himalaya, 3,000-6,000 ft. Upper Assam, Bengal, Bihar, Bombay Pres.

2. **Habenaria digitata** Lindl. Gen. & Sp. Orchid. (1835) 307; Hook. f. F.B.I. vi, 134 (*partim*); Kraenzl. Orch. Gen. & Sp. i (1897) 270; Cke. ii, 715 (*partim*).—*H. trinervia* Wight Ic. t. 1701.—*Bonatea benghalensis* Griff. in Calc. Journ. Nat. Hist. iv, 382.

Cooke has united *H. Gibsoni* Hook. f. with *H. digitata* Lindl. Cooke mentions in his description that the spur has an erect ligule at its mouth. In *H. Gibsoni* the ligule is absent. We treat *H. Gibsoni* as a distinct species.

Description: An erect ground orchid; tuber small, about 25 mm. diam., many fleshy roots from the stem above the tuber; stem tall, 30-60 cm. high, leafy. Leaves 5-12 cm. long, very variable, from ovate or orbicular to ovate-oblong or lanceolate and rarely narrowed into a short petiole, sessile on the sheath, papillosely ciliate. Raceme or spike about 12 cm., rather laxly many-flowered with greenish or green and white flowers with a resemblance to



Habenaria stenopetala Lindl. a close-up of the inflorescence.

Habenaria stenopetala Lindl. entire plant.

Photos by C. McCann.

insects. Bracts large lanceolate, 20-25 mm., often almost foliaceous and exceeding the flowers; pedicels very short or almost absent. Flowers 12-18 mm. broad. Lateral sepals 8-9 mm. long, somewhat obliquely ovate, acute, without filiform tips, dorsal shorter, very concave. Petals bipartite nearly to the base with linear segments, upper broader, erect, recurved, about 6-8 mm. long, lower segment spreading and often recurved; lip tripartite with linear segments, midlobe straight, nearly 12 mm. long, lateral segments more filiform, often decurved, longer or usually shorter. Spur 16 mm. long, subclavate, sometimes inflated, with an erect ligule at the mouth. Anther-cells parallel, tubes short, upcurved; glands of pollinia minute. Stigmatic processes clavate; rostellum erect, triangular. Capsule shortly pedicelled, 12 mm. long, fusiform with thick ribs.—The flowers sometimes have a disgusting odour (Haines).

Locality: *Konkan*: Karanja Island (Dalzell & Gibson); Wada (Herb. Econ. Bot. Poona !); Matheran (Paranjpye !).—*W. Ghats*: Khandala (Hallberg !); Lonavla (Garade !); Purandhar (Burns); Mahableshwar (Sedgwick 7585 !, McCann 2898 !, 2899 !); Panchgani (McCann 2902 ! 3029 !, Blatter P80 ! 215 !).—*S. M. Country*: 20 miles W. of Dharwar, in shade of trees (Sedgwick 2636 bis !); near Nagargalli, Belgaum Dist., inside the margin of forest amongst other undergrowth, 2,800 ft. high, rainfall about 80-100 in. (Bell & Sedgwick 2944 !).—*N. Kanara*: Near Karwar (Talbot !); Yellapur (Talbot !).

Distribution: Kashmir, Assam, Sylhet, Bengal, Tenasserim, W. Ghats, hill tracts from the Godavari Dist. and Mysore to Tinnevelly 2,000-6,000 ft.

Flowers: July 1917 (near Dharwar); Aug. (near Karwar); Sept. 1930 (Panchgani, Mahableshwar); Sept. 1917 (S. M. Country); Oct. 1882 (Yellapur); Oct. 1920 (Mahableshwar).

3. **Habenaria foliosa** A. Rich. in Ann. Sc. Nat. sér. 2, xv (1841) 71; Dalz. & Gibs. Bomb. Fl. 267; Wight Ic. t. 1700; Kraenzl. Orchid. Gen. & Sp. i. (1897) 273.—*H. digitata* Lindl. var. *foliosa* Hook. f. F.B.I. vi (1890) 135; Cke. ii, 716; Haines Bot. Bih. & Or. 1154; Fischer. in Fl. Madras. pt. viii (1928) 1469.

We follow Kraenzlin in restoring *H. digitata* var. *foliosa* to the rank of a species.—We are doubtful whether *H. laciniata* Dalzell in Kew Journ. Bot. ii (1850) 261 can be considered a synonym of *H. foliosa*. He mentions some characters which certainly do not fit in and which we have not observed in the Khandala specimens. It is more likely to be a distinct species, but as his specimen cannot be traced it will be difficult to decide the point. We have never found a plant in Salsette which answers completely Dalzell's description of *H. laciniata*.

Description: A terrestrial plant, 15-30 cm. high. Stem leafless at base, vaginate, sheaths loose. Leaves 5 by 2.5 cm., elliptic, acute, sheathing at base, imbricating, decreasing in size above. Racemes dense-flowered. Bracts ovate, acute, convolute at base, longer than the ovary. Flowers greenish or dirty white; sepals ovate; dorsal one broader and shorter than the lateral ones, 6 by 5 mm., lateral ones 8 by 3 mm., lanceolate. Petals, especially the extremities, green, deeply 2-cleft, upper segment 8 by 1.2 mm. long, lower lobe thinner and shorter. Lip 9 mm. long, tripartite to base, segments filiform, subulate, equal; spur 15 mm. long, inflated, length of ovary. Fleshy processes of column long, obtuse.

Locality: *Deccan*: On the hills about Kadakvasla near Poona (Cooke).—*W. Ghats*: Khandala, under a hedge (Sedgwick 2586 !); Mahableshwar (Talbot 4450 !).—*N. Kanara*: Karwar (Talbot 1902 !).

Distribution: Nilgiris, 4,000-7,000 ft. (Fischer), Manbhum (Haines).

Flowers: July 1917 (Khandala); Aug. 1889 (Karwar); Oct. 1905 (Mahableshwar).

4. **Habenaria Gibsoni** Hook. f. F.B.I. vi (1890) 135.—*H. digitata* Cke. ii, 715 (*partim*).—*H. digitata* Lindl. var. *Gibsoni* Fischer Fl. Madras pt. viii (1928) 1469.

We give first Hooker f.'s description:

A terrestrial plant; stem 20-30 cm. high, very stout, leafy; leaves 10-15 cm. long, linear-oblong; base sheathing. Racemes short, 6-8-flowered; bracts 25-38 mm. long, equalling or exceeding the ovary, membranous, broadly lanceolate, the lower exceeding the flowers. Flowers 25 mm. diam. Petals bipartite, segments narrow, subequal, upper segment broadest, fleshy; lip tripartite, segments linear-subulate, subequal, fleshy. Anther broad. Stigmatic processes adnate to the back of the broad mouth of the spur, spur without a ligule; rostellum small, triangular, exposed.

So far Hook. f. We add some of our observations:

Tuber 1, egg-shaped, small. Stem up to 35 cm., lower third covered with sheaths, then 1-3 ovate or obovate acute or mucronate leaves, followed by lanceolate leaves which are longer upwards, the top leaf sometimes exceeding the inflorescence. Leaves very thin, darker grass-green on the upper, very pale on the lower side, lanceolate or linear—or oblong-lanceolate-mucronate or acuminate, up to 15 by 3·5 cm., many nerves distinctly visible on the upper side. Racemes lax, secund or subsecund, up to 8 cm. long, 4-7-flowered. Flowers white, base and nerves of dorsal sepal greenish; column and rostellum green, clavate tips of spur green. Not smelling.

The following points distinguish this species from *H. digitata* Lindl.: The plant is more robust, the leaves are longer and narrower, the raceme is much shorter and the flowers much larger and fewer, the bracts are larger and there is no ligule at the mouth of the spur.

Locality: *Konkan*: Hills W. of Mulland, Salsette (McCann !).—*W. Ghats*: Khandala (McCann 25814 !, Blatter & Hallberg 25815 !, Blatter 25813 ! 25843 !, Hallberg 26527 !). Gibson mentions the same locality.

Distribution: Mysore (ex Fischer).

Flowers: July 1917 (Khandala); Aug. (Salsette).

Var. foetida Blatter & McCann, *var. nov.*

[*Planta valde foetens. Processus stigmatici adpressi ad labellum a latere faucium calcaris (non ad dorsum faucium). Ovarium tortuosulum. Lobus labelli centralis latior quam in typo.*]

Description: Dorsal sepal green; lateral sepal white, tinged with green. Upper lobe of petals green, lower green, white at base. Midlobe of lip broadest, all lobes green, white at base. Spur clavate, green, mouth without a ligule. Anther: Cells diverging below, separated from each other; connective green. Staminodes: 2 warty elongated greenish white processes. Rostellum shorter than anther, triangular, green, not united with or overlapping channel of anther-cells which open out just outside the lateral lobes of rostellum. Stigma: 2 oblong processes, white, appressed to the lip at the side of mouth of spur. Gland of pollinia exposed. Ovary twisted. Flower smelling badly.

Locality: Khandala, Monkey Hill (Hallberg ! in Herb. St. X.C.)

Flowers: June 1917.

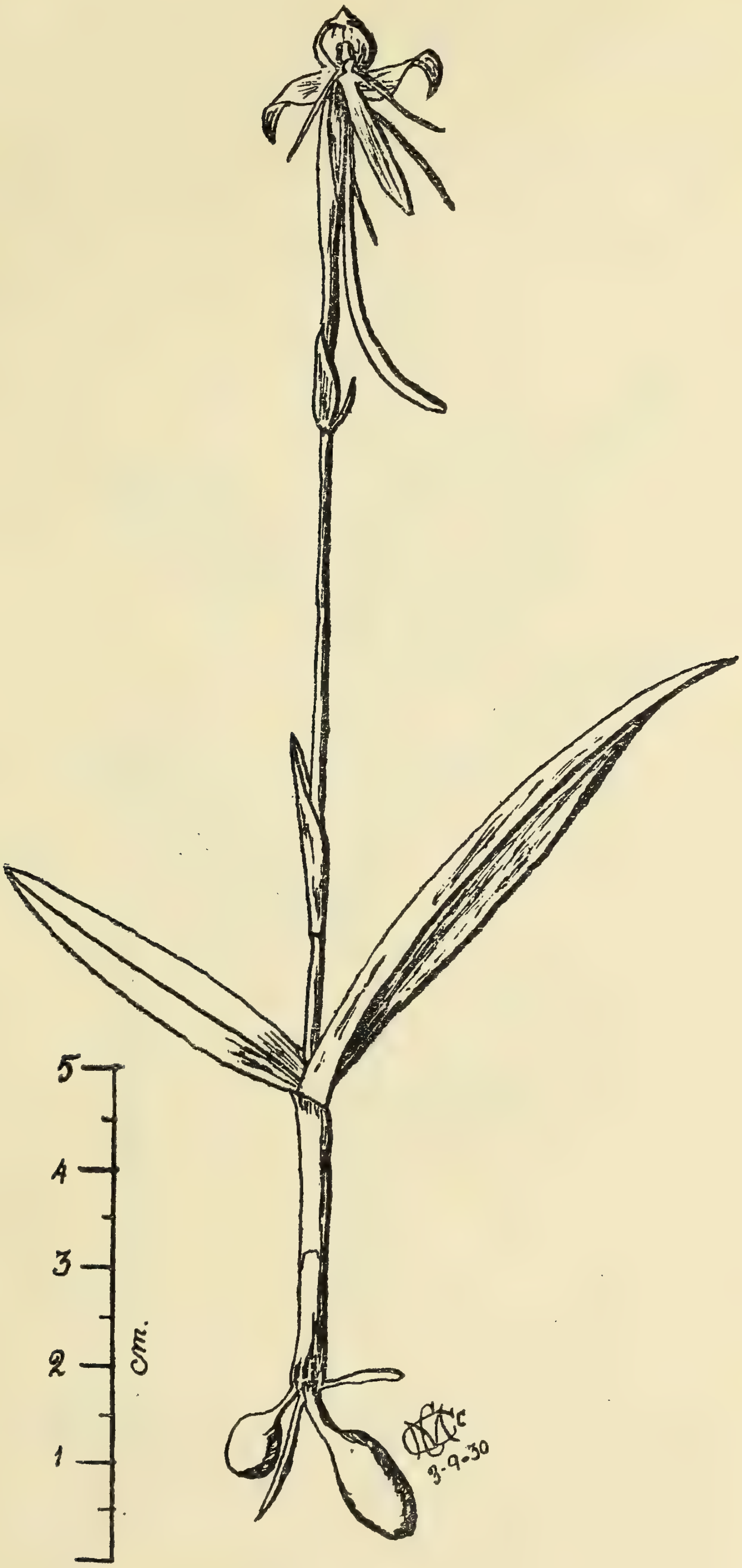
5. **Habenaria multicaudata** L. J. Sedgwick in Rec. Bot. Surv. India vi (1919) 352; Fischer Fl. Madras pt. viii (1928) 1469.

Description: An erect slender herb, up to 50 cm. high. Lower part of stem covered with obtuse appressed sheaths; the middle part leafy. Leaves elliptic-oblong, acute, many-nerved, trabeculate between the nerves, 6-15 cm. long, 2-4 cm. wide. Racemes up to 18 cm. long, many-flowered. Bracts 15 mm. long, shorter than the beaked ovary. Pedicel with the ovary up to 23 mm. long. Flowers white, spur brown and lip soon getting brownish. Dorsal sepal erect, cucullate, 6 by 4 mm., 3-nerved. Lateral sepals 8 by 5 mm., ovate, slightly falcate, acute, 3-nerved. Lateral petals bipartite, upper lobes erect, filiform, scarcely longer than the dorsal sepal, lower lobes up to 15 mm. long, filiform, fantastically contorted. Lip 3-partite, midlobe 10 mm. long, filiform, lateral lobes up to 25 mm. long, filiform, fantastically contorted. Spur 12 mm. long, curved, slender, slightly clavate at tip and subacute. Anther-cells very conspicuous and very large for the size of the flower, contiguous above, below broadly divaricate, tubes projecting. Pollinia very large, pyriform, caudicles scarcely longer; gland minute. Stigmatic processes elongate, appressed on both sides to the basal margins of the lip. Rostellum obscure.

Locality: *N. Kanara*: Guddehalli, a hill close to the sea-coast near Karwar, 1,500 ft., rainfall 150 in. (T. R. Bell 3045 ! type in Herb. Blatter); Karwar Hills, in thick jungle (T. R. Bell 7871 bis !); Katgal (Talbot !).

Distribution: N. Kanara, Nilgiri Hills, Anamalai Hills in Karianshola at 2,200 ft. (Fischer).

Flowers: Aug. 1883, 1920, Sept. 1917 (N. Kanara).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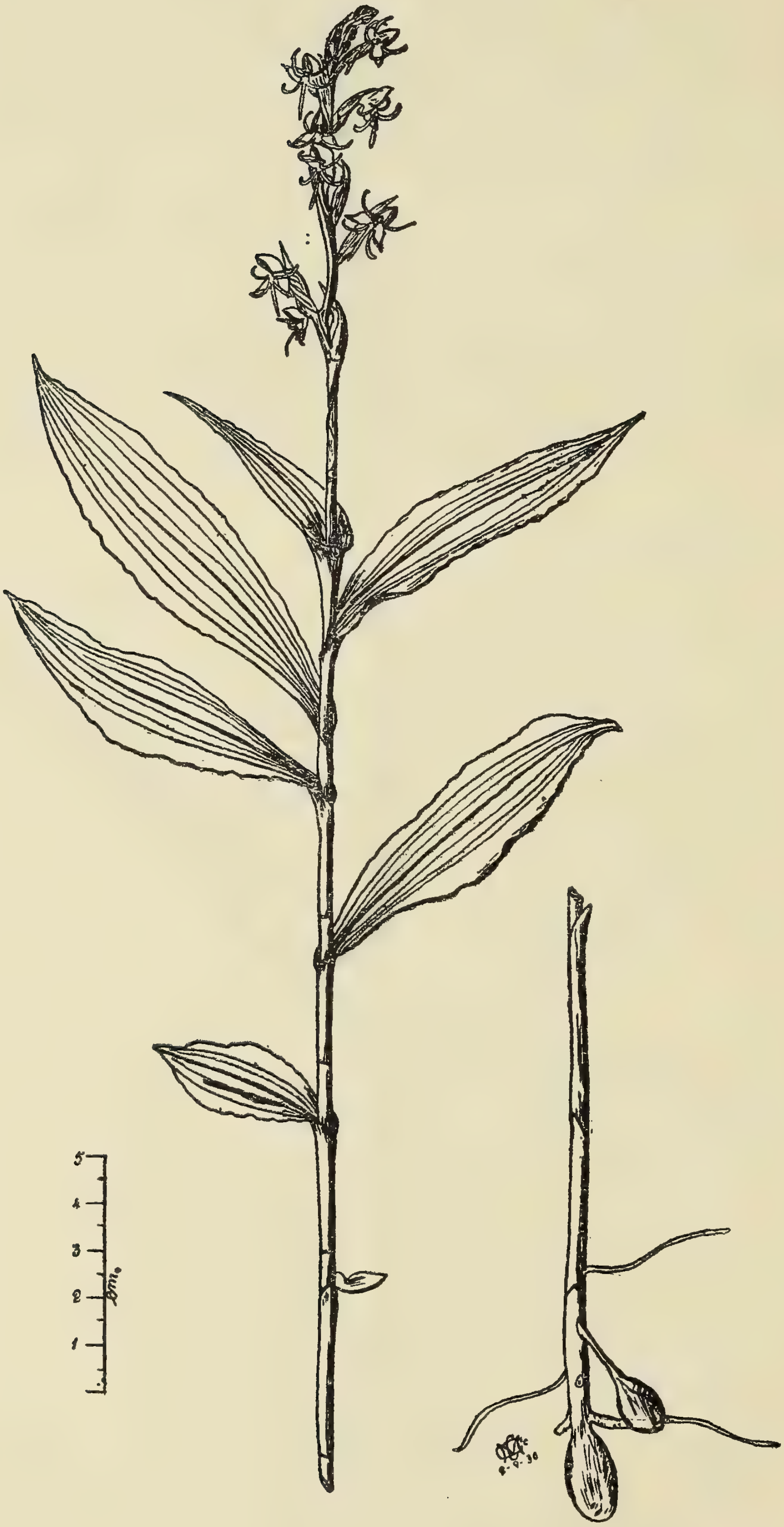
Del. C. McCann.

Habenaria rariflora A. Rich.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Habenaria Spencei Blatter & McCann, *sp. nov.*

6. **Habenaria Spencei**[1] *sp. nov.* Blatter & McCann.

[*Pertinens at sectionem Ate similis est Habenariae digitatae* Lindl. *a qua tamen differt omnibus florum partibus multo minoribus, lobis petalorum superioribus non intra sepala lateralia positis sed porrectis abeuntibus ultra sepala lateralia, lobis petalorum inferioribus quam superiores longioribus, sepalis lateralibus anguste ovato-lanceolatis acuminatis, sepalo dorsali ovato-acuminato cucullato 3-nervoso apice subobtuso, calcare paulo ovario breviore fusiformi dorsi-ventraliter applanato.*].

Description: Tubers undivided, elliptic, up to 3·4 cm. long; roots arising from the base of the stem, forming tubers. Stem about 45 cm. high, leafy in the upper half, with closely appressed sheaths in the lower. Leaves oblong-lanceolate, acuminate, membranous, pale green, sheathing at base, margin wavy, midrib depressed above, 3 less distinct parallel nerves on each side. Flowers pale yellow-green. Racemes lax, about 8-11—flowered, flowers on one side. Bracts usually shorter than the flowers, about 2 cm. long, ovate-lanceolate, acuminate. Pedicels hardly 1 mm. long. Dorsal sepal ovate-acuminate, cucullate, subobtuse at the apex, 7·5 mm. long, 3-nerved; lateral sepals up to 8·5 by 3·5 mm., narrowly ovate-lanceolate-acuminate, subfalcate, spreading. Petals 2-partite; upper segment as long as the dorsal sepal, subfalcate, linear, acute; lower segment narrower, filiform, slightly longer than the upper, spreading, recurved. Lip 3-partite, segments linear, acute, the middle one slightly longer than the lateral, 9 mm. long, lateral segments recurved, margin of midlobe reflexed. Spur slightly shorter than the ovary, 10·5 by 3 mm., spindle-shaped, flat dorsiventrally, lower portion whitish, rest greenish, with a ligule at the mouth. Stigmatic processes subclavate, not appressed to the lip. Anther-cells parallel, tubers upcurved, rostellum shorter than the anther, triangular, apiculate. Fruit not seen.

Locality: *W. Ghats*: Mahableshwar, Fitzgerald Ghat, in dense jungle, 4,000 ft. (McCann 3026 ! type, 3027 ! cotype).

Flowered: 28th. August 1930.

7. **Habenaria rariflora** A. Rich. in Ann. Sc. Nat. sér. 2, xv (1841) 70, t. 2, D; Dalz. & Gibs. Bomb. Fl. 268; Wight Ic. t. 924; Kraenzl. Orchid. Gen. & Sp. i (1897) 271; Cke. ii, 716; Fischer Fl. Madras. pt. viii (1928) 1469.—*H. uniflora* Dalz. in Kew Journ. Bot. iii (1851) 344.

Description: Cke. ii, 716.—Lip up to 15 mm. long; lateral segments of lip longer than or as long as, the midlobe; the lateral segments have a tooth-like lobe on the outer side near the apex.

Locality: *Konkan* (Stocks).—*Deccan*: Karkula, near Poona (Woodrow).—*W. Ghats*: Khandala (Hallberg 26497 !, Blatter 25842 !); Purandhar (Barnes, Bhide !); Panchgani (Cooke !, Blatter 211 !, Frenchman 212 !, Sedgwick 7911 bis !); Pasarni Ghat (McCann !).

Flowers: July 1917 (Khandala); July 1925 (Panchgani); Aug. 1919 (Khandala); Aug. 1921 (Panchgani); Sept. 1930 (Pasarni Ghat.).

Distribution: Konkan, Deccan, W. Ghats of Bombay and Madras Pres., 2,000-6,000 ft., Horsleykonda at 4,100 ft., Kollimalai Hills.

Var. latifolia *var. nov.* Blatter & McCann.

[*Folia ovato-acuta vel ovato-acuminata, ad 5 cm. longa et 2-3 cm. lata. Calcar quam in typo brevior.*]

Locality: Panchgani, 3rd. milestone towards Wai (Frenchman 213 !).

Flowers: July 1925.

Note: It is not impossible that this variety is a hybrid between *Habenaria rariflora* A. Rich. and *H. grandiflora* Lindl.

8. **Habenaria grandifloriformis** *sp. nov.* Blatter & McCann.

[*Orchidacea similis Habenariae grandiflorae* Lindl. *a qua tamen differt folio secundo valde variabili nunc simili primo, tunc oblongo-lanceolato et fere acuminato, petiolo vaginanti 1 cm. longo, racemis 1-7 floris, bracteis multo longioribus et ovariis aequilongis ovato-oblongis acutis, pedicellis quam ovaria duplo longioribus, sepalis lateralibus multo largioribus 5-nervosis, petalorum segmentis inferioribus longissimis, labio 22 mm. attingenti, labii lobis lateralibus medio multo longioribus, calcare usque ad 4 cm. longo.*]

Description: Terrestrial. Tuber irregular, undivided, usually flattened on one

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[1] After Sir Reginald Spence, for many years Hon. Secretary of the Bombay Natural History Society.

side, sometimes round, roots arising above the tuber, fleshy, brittle, numerous. Whole plant 7-22 cm. high, very slender. Leaves 1 or 2. Lower leaf broadly ovate, acute or orbicular-acute, apiculate, sometimes broader than long, base cordate amplexicaul, basal lobes rounded, up to 8 cm. long, 7 cm. broad, second leaf varying a good deal, shape as of first leaf, but generally narrower, sometimes oblong-lanceolate, almost acuminate, apiculate, basal lobes smaller, petiole sheathing about 1 cm. long. Flowers white, faint-scented, in lax 1-7-flowered racemes; scape ribbed and striate, with one sheath; bracts: lowest 2.2 cm. long, 1.3 broad, ovate-oblong, acute, green, getting smaller upwards, topmost subscarious. Pedicels up to 5 cm. long, much longer than the ovary, ribbed, ribs continuous with those of ovary. Lateral sepals 1.5 cm. long by 6 mm., broadly ovate-triangular, very oblique, almost acute, 5-nerved, nerves only in fading flowers distinctly visible; dorsal sepal 9 mm. long, 6 mm. broad, ovate, obtuse, apiculate, 5-nerved, cucullate. Petals 2-partite; upper segment 8 mm. long, 5 mm. broad, in shape resembling the lateral sepals, but shorter or almost semi-ovate-orbicular, lower segment 17 mm. long, filiform. Lip 22 mm. long, 3-partite, segments spreading, lateral segments filiform- to oval-shaped, about 5 mm. longer than the middle one; midlobe linear-lanceolate, or linear-oblanceolate, blunt at apex or slightly apiculate, 2 mm. broad. Spur up to 4 cm. long, curved, whitish above, lower part green, flattened, club-shaped at tip, with a groove on each flattened side. Anther 3-cuspidate, the middle one longest; cells parallel, tubes longer than broad, slightly diverging; gland of pollina large, orbicular, milky. Stigmatic processes large, club-shaped, white-waxy. Rostellum 3-lobed, the midlobe narrowly linear-apiculate, erect, hidden between the anther-cells, but longer than the cells, the side lobes very short, thicker than the midlobe, lying parallel with the stigmatic lobes. Ovary elongate-oblong, 6-lobed, slightly curved, 17-22 mm. long, green. Capsule having the shape of the ovary, curved, 2.8 cm. long, 0.5 cm. wide, truncate at top.

Called 'Snowdrop' locally at Panchgani.

Locality: *W. Ghats*: Panchgani, in grassland on Tableland (Blatter P. 20 ! type, P. 22 ! P. 23; cotypes. Sedgwick 7900 !); Khandala, in grassland, abundant (Blatter 25835 !, Hallberg 26501 !).—*Deccan*: Satara (Hallberg !).—*S. M. Country*: Dharwar, grassy hills, abundant (Sedgwick 2601 !).

The most common orchid at Panchgani, growing in almost any locality: in grass, in fields, along roads, and in rocky places.

Flowers: June and July 1925 (Panchgani); July 1917 (Dharwar, Khandala); Aug. 1916 (Khandala); Nov. 1921 (Panchgani).

Fruit: Aug. 1916 (Khandala).

The flowers appear after the first monsoon showers and new flowers have been noticed at Panchgani from the end of May to November.

Var. aequiloba *var. nov.* Blatter & McCann.

[*Labii lobi laterales lobo medio aequilongi vel eo breviores, surgentes 4 mm. supra labii basim.*]

Locality: Panchgani (Blatter P. 20a, type).

Flowers: Middle of July 1925.

9. **Habenaria grandiflora** Lindl. in Wall. Cat. (1828) 7032; Dalz. & Gibs. Bomb. Fl. 267; Hook. f. F.B.I. vi, 136; Kraenzl. Orchid. Gen. & Sp. i (1897) 337; Cke. ii, 716; Fischer Fl. Madras pt. viii (1928) 1469.—*H. rotundifolia* Lindl. Gen. & Sp. Orchid. (1835) 306.

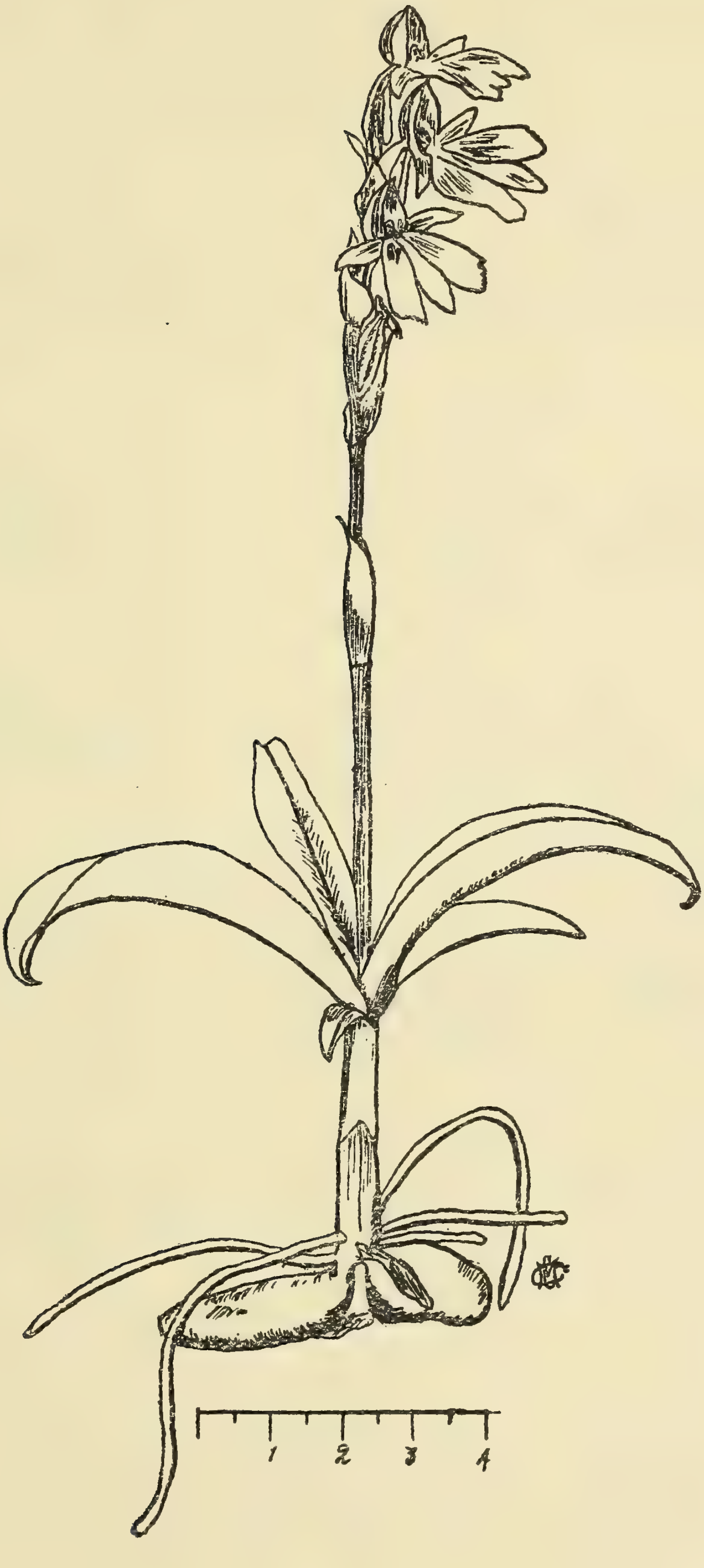
Description: Cke. ii, 716.

Locality: *Konkan*: (Stocks, Law).—*Deccan*: Maval, Poona Dist. (Stocks); Shivapur (Cooke !); Sinhagad, near Poona (Woodrow !, Bhide !); Purandhar (Woodrow !).—*W. Ghats*: Mahableshwar (Cooke !); Khandala (Sedgwick 2627 !).—*S. M. Country*: Belgaum (Stocks, Talbot 2436 !).

Distribution: Konkan, Deccan, W. Ghats, Bababudan and Shevaroy Hills.

10. **Habenaria platyphylla** Spreng. Syst. Veg. iii (1826) 690; Grah. Cat. 201; Wight Ic. t. 1709; Hook. f. F.B.I. vi, 140; Kraenzl. Orchid. Gen. & Sp. i (1897) 411; Cke. ii, 717; Haines Bot. Bih. & Or. 1155; Fischer Fl. Madras pt. viii (1928) 1470.—*Orchis plantaginea* Roxb. Corom. Pl. t. 37.

Description: Cke. ii, 717.—We have never seen a specimen of this species. There seems to be a difference of opinion with regard to the number and size of the leaves. Hooker mentions 3-6, which are 3-5 in. long, Cooke has the same number, but 2-4 in. long, Fischer has observed the same number of



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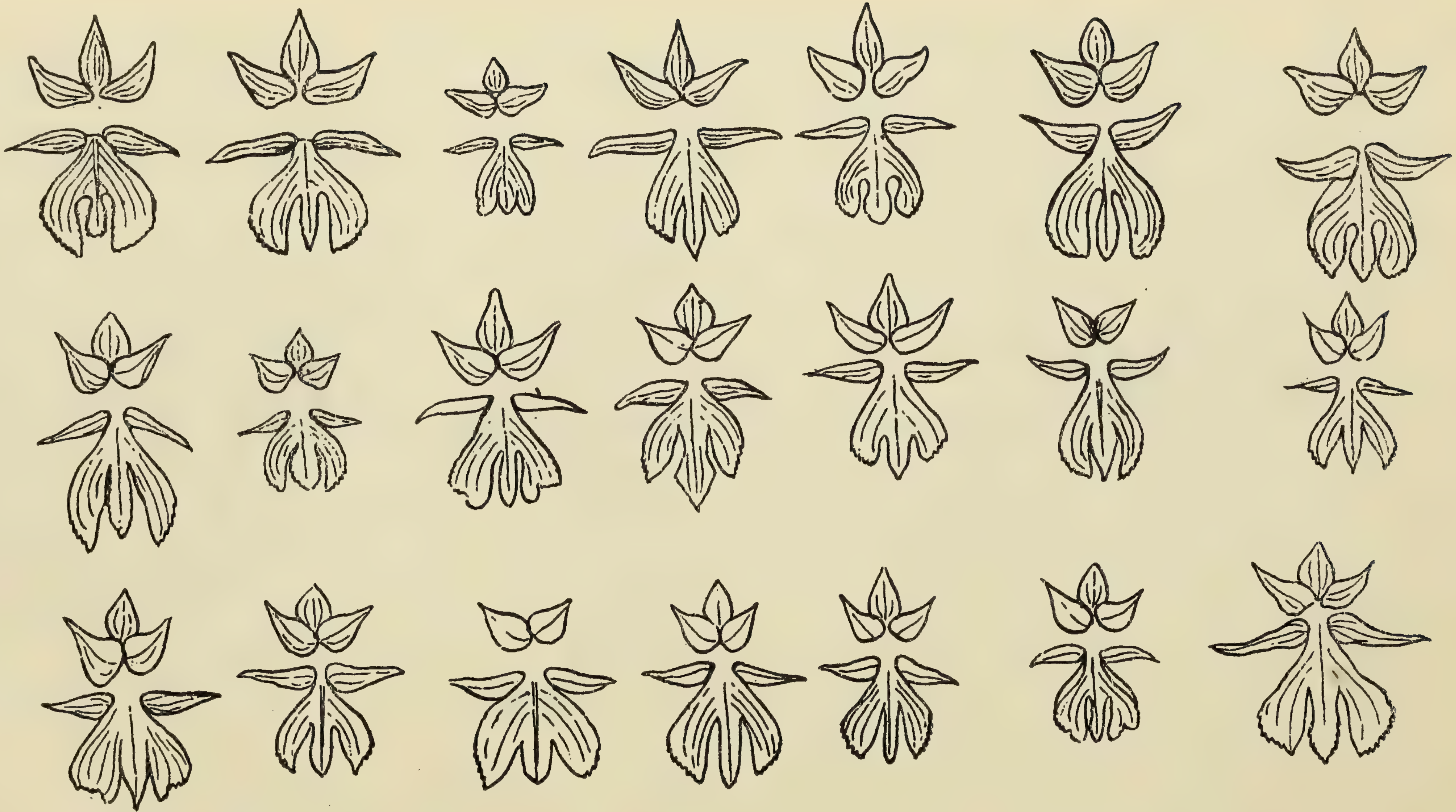
Habenaria variabilis Blatter & McCann, *sp. nov.*



Habenaria variabilis Blatter & McCann, *sp. nov.* showing the extreme variation in the formation of the floral parts.

Del. C. McCann.

leaves, but 1.5-5 in. in length. These discrepancies can be reconciled with each other. Haines, however, differs entirely. 'Leaves,' he says, 'always 2 wherever I have seen it (ranging from Chota Nagpur to Chanda in the Central Provinces)'. The length of his leaves is 1.5-3 in.

Locality: Konkan, Belgaum, Dharwar.

Distribution: Chota Nagpur, Central Provinces, Konkan, S. M. Country, in all districts of Madras Pres. near sea-level up to 3,500 ft.

11. **Habenaria suaveolens** Dalz. in Kew Journ. Bot. ii (1850) 263; Dalz. & Gibs. Bomb. Fl. 268; Hook. f. F.B.I. vi, 140; Kraenzl. Orchid. Gen. & Sp. i (1897) 416; Cke. ii, 717; Fischer Fl. Madras pt. viii (1928) 1470.

Locality: Konkan (Dalzell); between Vengurla and Malvan, rare (Dalzell & Gibson.)

Distribution: Konkan, Bababudan Hills.

12. **Habenaria variabilis** *sp. nov.* Blatter & McCann.

[*Persimilis Habenariae suaveolenti* Dalz. *sed. differt foliis minoribus nunquam linearibus vel lineari-oblongis, floribus multo largioribus in racemis densis usque ad 11-floris, labio sepalo dorsali duplo longiore, labii lobo medio 5 mm. lato, calcare ovario multo breviore, polliniis oblongis aliquomodo obliquis minime clavatis, caudiculis tenuissimis, glandibus disciformi-oblongis profunde concavis.*]

Description: Tuber egg-shaped, undivided; roots many, stout, fleshy, brittle, arising from above the tuber. Stem up to 12-22 cm. high, clothed at the base below the leaves with a few sheaths. Leaves 3-5, arising about 3 cm. above ground, 4-8 cm. long, 1-2.5 cm. broad, sheathing, lanceolate or oblong-lanceolate, subacuminate or acuminate, 5-nerved, followed higher up by 1 or 2 bract-like oblong- or ovate-lanceolate acuminate leaves. Flowers large, white, fragrant, in few- to many-flowered (usually 3-4, but also 2-11) secund or subsecund dense racemes (base of upper flower touching the tip of lower); bracts 2 by 1 cm., ovate-acuminate, getting smaller upwards, shorter than the pedicelled ovary, very rarely exceeding it; inflorescence 4-12 cm. long. Lateral sepals 14 by 6 mm., elongate-triangular, falcate, acute; dorsal 11 by 6 mm., broadly ovate-acute, cucullate. Petals 12 by 7 mm., obliquely ovate-acute, almost covered by dorsal sepal. Lip 22 by 24 mm., divided into 3 lobes to half way down more or less; side lobes up to 9 mm. broad, obliquely truncate, the truncate part finely crenulate; midlobe slightly longer than the side lobes, 5 mm. broad, broadly or narrowly lanceolate, sub-acute. Spur 11 mm. long, straight or very slightly bent near base, much shorter than the ovary, subclavate at apex, white near base turning greenish towards apex. Gynostemium 4-5 mm. Anther-cells parallel, apex acute, a central longitudinal groove on back; anther-tubes 0; pollinia 2.5 mm. long, oblong, slightly oblique, yellow, granular; caudicles slender, white, transparent, as long or shorter than the pollinia; pollen yellow, oblong, obliquely truncate at both ends, slightly flattened. Glands exposed, disk-shaped-oblong, deeply concave above, white-transparent. Stigmatic processes very short, greenish yellow. Rostellum triangular. Ovary 17 mm. long, sessile or subsessile, elongate, 6-ribbed. Fruit sessile or subsessile, 2.5 cm. long, 7 mm. diam., spindle-shaped, with 6 strong ridges, green.

Locality: *W. Ghats*: 3rd. milestone from Panchgani to Wai (Frenchman P. 21 ! type); Panchgani on Tableland, in grass (Hallberg 26494 !, Blatter P. 55 ! 200 ! 201 ! 202 ! 203 ! 204 !, Sedgwick 7908 bis !); Mahableshwar, on rocky ground near lake (Mozelle Isaacs and Blatter 205 ! 206 !, McCann !). Very common at Panchgani.

Flowers: July 1925 (Panchgani, Mahableshwar); Aug. 1925 (Panchgani).

The flowers are all turned eastwards on the Tableland of Panchgani owing in all probability to the strong west wind.

Note: Our first impression was that this plant was identical with *Habenaria suaveolens* Dalz. Only when we had seen Dalzell's specimen collected in the Konkan (Herb. Calcutta) it became evident that our specimens belonged to a different species, though approaching *H. suaveolens* with regard to many points.

The new species is very variable, at least regarding size and shape of lip. The illustration shows a number of variations which could easily be multiplied.

We are inclined to think that our species is a hybrid between *H. suaveolens* and another species not known to us. It is also possible that the new species is in a state of evolution, perhaps derived from *H. suaveolens.*

It is surprising that this plant should not have been noticed before. But the same fate has attended many other ground orchids and other Monocotyledons. The explanation why they have been overlooked is very likely to be found in the fact that the W. Ghats are not usually visited during the rains.

13. **Habenaria longicalcarata** A. Rich. in Ann. Sc. Nat. sér. 2, xv (1841) 71, t. 3, B; Dalz. & Gibs. Bomb. Fl. 268; Wight Ic. t. 925; Hook. f. F.B.I. vi, 141; Kraenzl. Orchid. Gen. & Sp. i (1897) 418; Cke. ii, 718; Haines Bot. Bih. & Or. 1156; Fischer Fl. Madras pt. viii (1928) 1470.—*H. longicorniculata* Grah. Cat. Bomb. Pl. (1839) 202.

How to distinguish this species from *H. decipiens* Wight and *H. longicornu* Lindl. see Fischer in Journ. Ind. Bot. Soc. vi (1927) 113.

Description: Cke. ii, 718.

Locality: *Konkan* (Jacquemont 598); Ambenali (McCann !); Konkan Ghats (Stocks 22); Khandala to Kampoli (Garade !).—*Deccan*: Purandhar (Kanitkar !): Katraj Ghat (Blatter & Hallberg 26526 !, Garade !, Shevde !).—*W. Ghats*: Khandala (Chibber 90 !, Gammie 15467 !); Lonavla (Herb. Econ. Bot. Poona !); Bhor Ghat (Cooke !); Castle Rock (T. R. Bell 4370 !).—*S. M. Country*: Near Belgaum, abundant (Dalzell & Gibson); Londa (Spooner !); W. of Dharwar (Sedgwick).—N. Kanara: Yellapur (Talbot !, Herb. Calc.); Siddhapur, grassland (Sedgwick 7010 !).

Distribution: Konkan, Deccan, W. Ghats. S. M. Country, N. Kanara, throughout the W. Ghats of the Madras Pres., Bellary Dist., Bihar and Orissa.

Flower: July 1882 (Yellapur); Aug. (Katraj Ghat); Sept. 1918 (Castle Rock).

Fruit: Oct. 1919 (Siddhapur).

Var. viridis *var. nov.* Blatter & McCann.

[*Planta 90 cm. alta. Folia adnumeratis foliis superioribus bracteiformibus 20. Racemus 6-florus. Sepalum dorsale, rostellum necnon anthera pallide viridia. Sepalum dorsale album viridi-subfusum. Petala viridia. Processus stigmatici et staminodia minuta atro-viridia. Rostellum distinctum.*]

Locality: W. Ghats: Khandala (Hallberg !, Herb. St. X. C.).

14. **Habenaria plantaginea** Lindl. Gen. & Sp. Orchid. (1835) 323; Wight Ic. t. 1710; Hook. f. F.B.I. vi, 141; Trim. Fl. Ceyl. iv, 229; Kraenzl. Orchid. Gen. & Sp. i (1897) 413; Prain Beng. Pl. 1030; Duthie in Ann. Roy. Bot. Gard. Calc. ix, pt. 2, 181, t. 132; Cke. ii, 718; Haines Bot. Bih. & Or. 1155; Fischer Fl. Madras pt. viii (1928) 1470.—*Orchys platyphyllos* Roxb. Fl. Ind. iii (1832) 609.

Description: Cke. ii, 718.

Locality: *Konkan*: (Dalzell); Matheran (Birdwood); Ambenali, below Mahableshwar (McCann & Blatter !).—*W. Ghats*: Ambenali Ghat near Lonavla (Kanitkar); Mahableshwar, forests (Sedgwick 4555 !, Sedgwick's collector 7591 bis !).—*N. Kanara*: Siddulgundi (Talbot 701 !); Guddehalli, above Karwar (Bell !); Katgal, evergreen (Sedgwick 6865 !).

Distribution: Outer Himalayan ranges of Garhwal and Kumaon up to 7,000 ft., Sikkim, Bengal, Bihar, Central India, Konkan, W. Ghats, Deccan, N. Kanara, in all districts of the Madras Pres., 800-4,000 ft.

Flowers: Oct. 1930 (Ambenali); Oct. 1920 (Mahableshwar); Nov. 1918 (Mahableshwar); Nov. (N. Kanara).

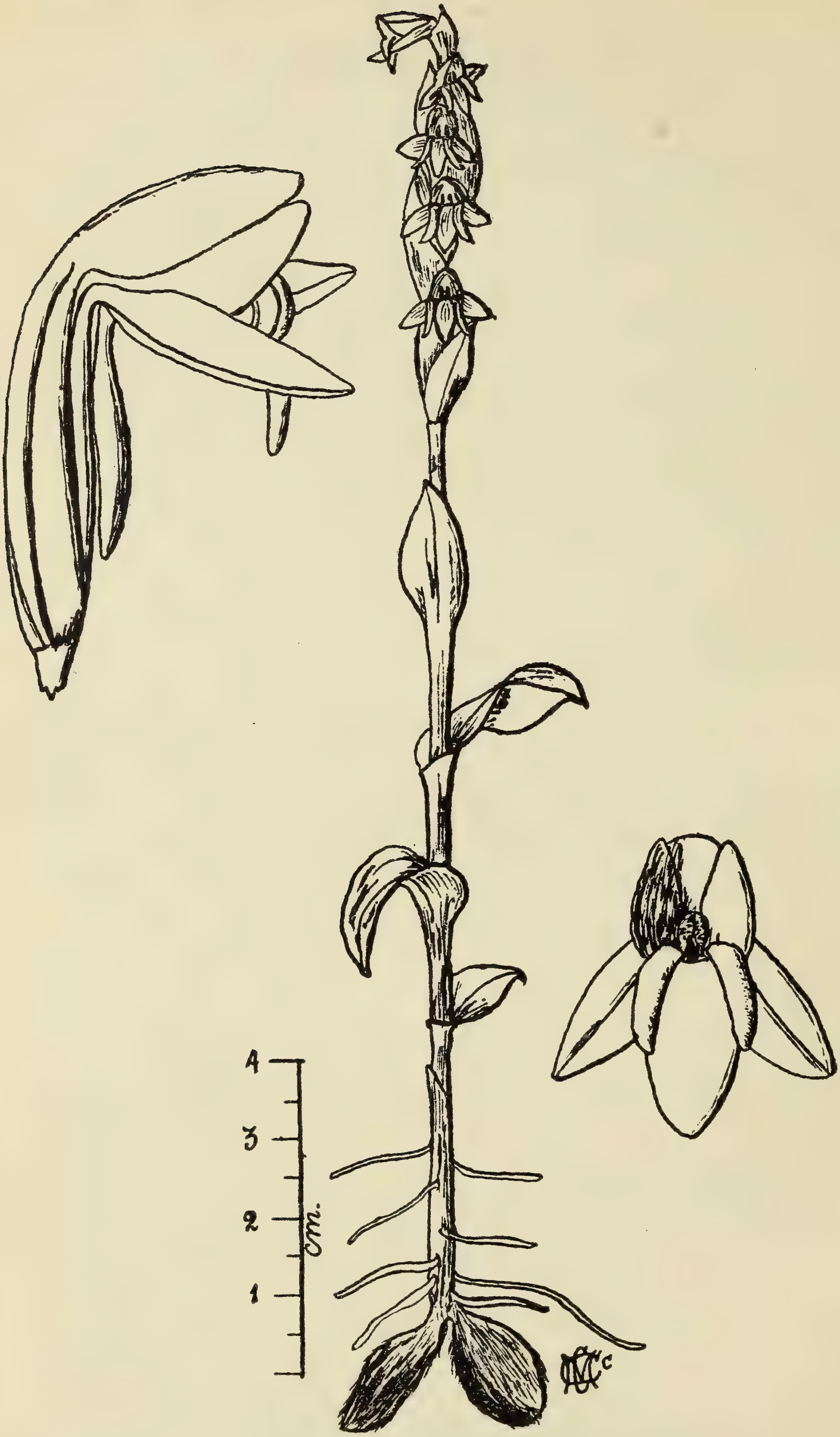
15. **Habenaria crinifera** Lindl. Gen. & Sp. Orchid. (1835) 323; Dalz. & Gibs. Bomb. Fl. 269; Wight Ic. t. 926; Trim. Fl. Ceyl. iv, 229; Hook. f. F.B.I. vi, 142; Kraenzl. Orchid. Gen. & Sp. i (1897) 424; Cke. ii, 718; Fischer Fl. Madras pt. viii (1928) 1471.—*H. schizochilus* Grah. Cat. Bomb. Pl. (1839) 252.

Description: Cke. ii, 718.

Locality: *Konkan*: Vengurla (Dalzell & Gibson).—*S. M. Country*: *Ramghat* (Dalzell ex Stocks 5).

Distribution: Konkan, S. M. Country, W. Ghats of Madras Pres. below 4,000 ft.

16. **Habenaria commelinifolia** Wall. ex Lindl. Gen. & Sp. Orchid. (1835) 325; Kraenzl. Orchid. Gen. & Sp. i (1897) 322; Hook. f. F.B.I. vi, 143; Prain Bengal Pl. 1031; Cke. ii, 719; Duthie in Ann. Roy. Bot. Gard. Calc. ix, pt. 2, 183, t. 134; Haines Bot. Bih. & Or. 1157; Fischer Fl. Madras pt. viii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Habenaria cerea Blatter & McCann, *sp. nov.*

(1928) 1470.—*Orchis commelinifolia* Roxb. Fl. Ind. iii (1832) 451; Grah. Cat. Bomb. Pl. 201.

Description: Cke. ii, 719.—We add the following details: Tubers large, ellipsoid or cylindric. Leaves acute or often subspinescent at the apex, margins pale. Bracts scaberulous on both surfaces, ciliolate on the margins. Sepals scaberulous, dorsal greenish with white margins; lateral sepals spreading, with many veins deeply looped or arched. Midlobe of lip linear, channelled above, curved, tapering, with a knee about 1 mm. from the tip, scaberulous. Spur slender, curved downwards, its upper portion funnel-shaped and white, the apex clavate, green. Anther-cells elongate, distant, diverging at the base; tubes long, straight, fused with the arms of the rostellum along their whole length. Pollinia small, oval, yellow, caudicles very long, 10 mm., very elastic, filiform, broader above, translucent; glands minute, orbicular. Staminodes white, seated on the long arms of the white column and curving round in front of the anther-tubes.

According to Cooke the dorsal sepal measures 10 mm. and the lateral ones 12 mm. Duthie says that the lateral sepals are much shorter than the dorsal one. In Hallberg's specimen from Salsette the dorsal sepal measures 6 mm. only.

Locality: *Konkan*: (Dalzell); Salsette (Hallberg !); S. of Tulsi lake in grassland (McCann !); Bassein (Ryan 1341 !); S. Konkan in pasture lands (Graham).—*Deccan*: Purandhar (Bhide !).—*W. Ghats*: Khandala (Woodrow).—*N. Kanara*: Yellapur, in forests, 2,000 ft. (T. R. Bell 3101 ter !); in evergreen and deciduous forest (Talbot 702 !).

Distribution: Outer ranges of W. Himalaya, from the Punjab to Kumaon, up to 5,000 ft., extending eastwards to Parasnath, Chota Nagpur, Bihar and Upper Burma, Central India, Konkan, W. Ghats, Deccan, N. Kanara, Bababudan Hills.

Flowers: Oct. 1919 (Yellapur).

17. **Habenaria cerea** *sp. nov.* Blatter & McCann.

[*Sect. Trimeroglossa. Accedit ad H. Heyneanam* Lindl. *sed facile distinguitur foliis distichis vel subdistichis minime subimbricatis, bracteis quam flores multo brevioribus, sepalis inaequalibus, floribus multo maioribus generatim albis, calcare medio aliquantulum incrassato non subclavato apice medium ovarium attingente, glandula triangulari non orbiculari.*]

Description: A terrestrial plant. Tubers 1 or 2, globose or oblong, strong fleshy fibrous roots arising above the tuber and for about 2.5 cm. above it on the stem. Stem up to 25 cm. high, stout, straight, rigid, leafy. Leaves alternate, distichous or subdistichous oblong or ovate or ovate-oblong, acute or acuminate, apiculate, leathery, rigid, 4.5 cm. by 15-18 mm., main nerve deeply depressed above, prominent beneath, the lower leaves smaller, the upper passing into bracts, sheathing at base. Flowers generally white, sometimes greenish yellow, sometimes both on the same plant, fleshy, wax-like, rigid, secund, growing at a right angle to the stem, shortly pedicellate, pedicel 1-2 mm. long, in dense racemes 4-6 cm. long, flowers touching each other. Bracts imbricating, broadly ovate, cucullate, 3-5-nerved, acute or acuminate, getting smaller upward, much shorter than the flowers, margin scarious, (devoid of chlorophyll). Pedicels with ovary up to 17 mm. long. Lateral sepals up to 10 mm. long, 4 mm. broad, oblong, falcate (i.e. straight on the upper, rounded on the lower edge), spreading; dorsal sepal ovate-oblong, rounded at tip. Petals up to 9 mm. long, 3 mm. broad, falcate, acute. Lip up to 10 by 6 mm. long, claw 1 mm. long and broad, a little above the claw the lip divided into 3 parallel lobes; midlobe 7 by 2-3 mm., oblong, blunt; side lobes linear, 5 by 1-1.5 mm. blunt, not in the same plane as the midlobe, but slightly raised, all bent down. Spur 7-8 mm. long, green, straight, appressed to the ovary, uniformly thick except for a very slight thickening in the middle, only half as long as the ovary. Caudicles very slender, transparent, as long as the diameter of the large spherical yellow pollinia; gland flat, triangular, white. Pollen grains mostly triangular. Stigmatic processes large, spreading, in the lower part adnate to the claw of the lip; no anther-tubes. Fruit spindle-shaped, about 12 mm. long, 4 mm. diam., strongly 6-ribbed; pedicel 4 mm. long, adnate to the axis.

A very distinct species, not variable at all except regarding the size of the different parts of the flower in young and adult flowers and in plants growing in different localities. The stem is usually stout and rigid, but sometimes in shady places slender, with fewer leaves more distant from each other.

This species approaches *Habenaria Heyneana.* It differs, however, in the following details: Flowers generally white, leaves differently shaped and distichous, or subdistichous, bracts much shorter than the flower, shape of lateral and dorsal sepals different. Flowers larger, spur not subclavate at tip, but with a slight thickening about the middle, gland flat triangular, not orbicular.

Locality: *W. Ghats*: Panchgani, Tableland, 4,400 ft., rainfall 60 in., in grassland (Blatter P. 73 ! type, P. 74 ! P. 75 ! P. 76 ! cotypes, Sedgwick 7907 bis ! 7568 !): Mahableshwar, near Lake (McCann !).

Very common on the First Tableland of Panchgani, in grassland, visible from a great distance in the very short grass. We have found it in flower during Aug., Sept. and beginning of Oct.

Locally the plant is called 'Tooth-Brush'; the name is not very poetical but expressive.

Var. polyantha *var. nov.* Blatter & McCann.

[*Multo maior quoad omnes partes vegetativas atque sexuales. Flores in 3-5 seriebus longitudinalibus parallelis dispositi et valde numerosi* (*usque ad* 40).]

We found this plant on the 25th. Aug. 1926 in grassland on the Third Tableland of Panchgani. The ground was simply covered with it, all the flowers turned eastwards. (Blatter 255 ! type.)

We have long doubted whether we should make this plant a new species or a variety of *H. cerea.* We cannot find the slightest difference between the flowers of the new variety and *H. cerea*, except for the fact that the flowers of the new variety are almost twice the size; but the proportions of the different flower parts are exactly the same in both. Flowers with cream coloured petals and lip are perhaps more numerous in the variety than in the type.

Otherwise the plant looks quite different from *H. cerea.* It grows up to a height of 45 cm. The inflorescence reaches 15 cm. and is up to 4 cm. broad. The flowers are arranged in 3-5 longitudinal parallel rows. The flowers of the inner rows look all one way, but those of the external rows stand almost at a right angle to the others, not being able to overcome the resistance of the coriaceous bracts.

It is strange that the type should grow on the First Tableland, not mixed with any specimens of the variety, whilst the variety is found on the Third Tableland. The two Tablelands are divided from each other by a shallow valley not more than a 150 ft. deep. The soil and rain conditions as well as exposure are the same on both Tablelands.

18. **Habenaria Heyneana** Lindl. Gen. & Sp. Orchid. (1835) 320; Dalz. & Gibs. Bomb. Fl. 268; Wight Ic. t. 923; Hook. f. F.B.I. vi, 148; Kraenzl. Orchid. Gen. & Sp. i (1897) 375; Cke. ii, 719; Fischer Fl. Madras pt. viii (1928) 1471.—*Platanthera Heyneana* Lindl. in Wall. Cat. 7044.—*Habenaria glabra* A Rich. in Ann. Sc. Nat. sér. 2, xv, 75, t. 5, A.—*H. subpubens* A Rich. Ic. t. 4, c; Kraenzl. Orchid. Gen. & Sp. i (1897) 361; Hook. f. F.B.I. vi, 148; Cke. ii, 720.—*H. candida* Dalz. in Kew. Journ. Bot. ii (1850) 262; Dalz. & Gibs. 267.

We had united *H. subpubens* A. Rich. with *H. Heyneana* Lindl. some six years ago, but we did not feel confident to publish the reduction, because we had not seen the material which had induced Hook. f. and Cooke to keep the two species distinct. It is true Hook. f. had already remarked in his Fl. Brit. Ind. (vi, 149) when describing *H. subpubens*: 'Very near *H. Heyneana*, and perhaps only a form of it, but more slender, leaves scattered linear 2-2½ in., bases narrowed, bracts narrower, flowers white, lip very different, spur more slender, anther apiculate, glands of the pollinia approximate and even cohering oblong with recurved sides, stigmatic processes longer, adnate to the claw of the lip.'

Wight already seems to have felt the same difficulty in the text to Ic. 1708-04. Cooke l. c. did not decide the point and he was satisfied with adding to his description of *H. subpubens*: 'Scarcely distinct from *H. Heyneana.*'

It was only in 1928 that Fischer when going through all the material relating to the two species for the preparation of pt. viii of Gambel's Flora of Madras, took the decisive step and reduced *H. subpubens.* 'After a careful examination' he says, 'of a number of sheets I am unable to keep this species separate from *H. Heyneana* Lindl. All the features cited as distinctive by the several authors who keep them apart vary considerably and in some cases the characters mentioned do not agree with the descriptions and figures. I could find no one constant distinguishing feature and must combine the two under the older name of Lindley.' (Kew Bull. 1928, p. 284).

Description: See Cke. ii, 719 and 720.—We cannot do better than add Fischer's short characteristic taken from his key to the Madras Habenarias:

Plant 10-37 cm. high. Leaves subimbricate, sheathing, ovate or linear, acute, 2-6 cm. Spike 5-10 cm. long. Bracts cucullate, acuminate, sheathing the secund flowers, lower 2.5 cm. long, smaller upwards. Sepals subequal, obtuse. Petals as long, narrower. Lip as long, 3-partite; side lobes linear, obtuse, usually shorter than the broader midlobe; spur subclavate, as long as or shorter than the beakless ovary.

Locality: *Konkan*: (Law, Dalzell); S. Konkan (Dalzell 78); Wary Country (Dalzell & Gibson).—*W. Ghats*: Lonavla (Hallberg 2650 !); Panchgani (Blatter & Hallberg B1687 !, Hallberg 26502 ! 26503 !, Blatter 1877 !); S. Ghats (Stocks 12); Castle Rock (Sedgwick 2762 bis ! 4184 !); Tinai Ghat (Talbot 2520 ! Herb. Calc.).—*Deccan*: (Stocks 60); Karli (Jacquemont 619); Purandhar (Bhide 1029 !).—*S. M. Country*: Dharwar (Law); Londa (Spooner !).—*N. Kanara*: Sirsi (Dalzell); without locality (Talbot 2520 !).

Flowers: Aug. 1917 and 1918 (Castle Rock); Sept. 1884 (Lonavla); Nov. 1918 (Sirsi).

Fruit: Oct. 1920 (Panchgani).

Distribution: Konkan, Deccan, S. M. Country, Kanara, W. Ghats of Bombay and Madras Pres., 2,500-8,000 ft.

19. **Habenaria affinis** Wight Ic. v, pt. i (1852) 13, t. 1707 (*non* Don); Kraenzl. Orchid. Gen. & Sp. i (1897) 324; Hook. f. F.B.I. vi, 149; Prain Beng. Pl. 1031; Cke. ii, 720; Haines Bot. Bih. & Or. 1157; Fischer Fl. Madras pt. viii (1928) 1471.

Description: Cke. ii, 720.—We have not seen this species.

Locality: *Deccan*: Purandhar (Woodrow).—*S. M. Country*: Belgaum (Ritchie 17).

Distribution: Bengal, Bihar, Central India, Deccan, S. M. Country, Nilgiri Hills, Anamalai Hills, Rampa Hills, 2,000-4,000 ft.

20. **Habenaria ovalifolia** Wight Ic. t. 1708 (*non* 1706); Fischer Fl. Madras, pt. VIII (1928), 1471.

Locality: *Konkan*: Hillside of Kanari Caves, in dense forest common (McCann 1152 !); Hills west of Mulland, in dense forest (McCann 1314 !).

Flowers: 15-9-29 (Kanari Caves); 11-8-29 (Hills W. of Mulland).

Fruit: 22-9-29 (Hills W. of Mulland).

21. **Habenaria marginata** Coleb. in Hook. Exot. Fl. (1825) t. 136; Grah. Cat. 201; Dalz. & Gibs. Bomb. Fl. 268; Kraenzl. Orchid. Gen. & Sp. i, (1897) 360; Hook. f. F.B.I. vi, 150; Prain Beng. Pl. 1031; Cke. ii, 721; Duthie in Ann. Roy. Bot. Calc. ix, pt. 2,184, t. 136; Fl. Upp. Gang. Pl. iii, 226; Haines Bot. Bih. & Or. 1157; Fischer Fl. Madras pt. viii (1928) 1471.—*H. fusifera* Hook. f. F.B.I. vi, 147.

We have reduced *H. fusifera* Hook. f. following Fischer who has examined the type specimen in the Herb. Calc. and who is of opinion that it is identical with *H. marginata* Coleb.

Description: Cke: ii, 721.

Locality: *Konkan*: (Law, Dalzell); S. Konkan (Stocks 6); Karanja (Dalzell & Gibson); Uran, in Bombay Harbour (Dalzell); Trombay (Hallberg !); Boisar (Hallberg !); Vehar Lake (McCann !); Mulland (McCann !); S.-W. of Vehar Lake (McCann !).—*Deccan*: Junnar near Poona (Stocks); Poona (Hallberg !); Kharkala, Poona Dist. (Hallberg 26496 !); Purandhar (Woodrow).—*S. M. Country*: Dharwar, common in dampish pasture land, usually in pure association of *Vetiveria Lawsoni* Blatter & McCann (Sedgwick 6207 bis ! 2800 ! 2674 !).—*N. Kanara*: Near Karwar, grassland, sea level (Sedgwick 6727 ! 6543 !); forest near Yellapur (Talbot !); Supa, wayside (Talbot !); Guddehalli, near Karwar (Sedgwick 5155 !).

Distribution: W. Himalaya, from Kashmir to Kumaon, up to 7,000 ft., Bengal, Burma, Bihar, Mt. Abu, Bombay Pres., Madras Pres.: W. Ghats, 1,500-3,000 ft., Nallamalai Hills at 1,500 ft.

Flowers: July 1917 (Dharwar); Aug. 1917 (Dharwar and Baisar); Sept. 1926 (Vehar Lake); Oct. 1919 (Karwar); Oct. 1882 (Yellapur); Oct. 1885 (Supa).

Forma flavescens Blatter & McCann.—*Habenaria flavescens* Hook. f. F.B.I. vi. 150; *var. flavescens* Th. Cooke Fl. Bomb. Pres. ii, 721.

Description: Cke. l. c.

Locality: Konkan (Law).

22. **Habenaria Hallbergii*** *sp. nov.* Blatter & McCann.

[*Sect. Trimeroglossa. Similis Habenariae ovalifoliae* Wight, *sed recedit ab ea bracteis lanceolato-subulatis quam flores longioribus, calcare paullum curvato lineari turtuoso, aliquantulum compresso apice clavato, labelli lobis aequilongis, lateralibus anguste linearibus rigidis patentibus, glandulis angustis longissimis*].

Description: Stem stout, up to 30 cm. high. Leaves 4-5, clustered near the base, sessile, amplexicaul, sheathing with a stout midrib, large, 20 by 5 cm., ovate-oblong, acuminate, many-nerved, glabrous. Several long-acuminate green appressed sheaths above, 4 by 2·5 cm., passing into bracts, with a decurrent midrib and slightly decurrent base, so that the stem is angular, especially below the spike, half amplexicaul. A smaller leaf about half way up the stem. Bracts 2·2 cm. by 1·8 mm., narrowly lanceolate-subulate, long-acuminate, with strongly decurrent midrib and base, overtopping the flower. One spike. Sepals green, ovate, obtuse, subequal in length, dorsal slightly broader, hooded, lateral spreading, all 3-nerved, with a narrow membranous margin, nerves ending before reaching the tip. Petals connivent with dorsal sepal and also at the tips with midlobe of lip, lip inflexed. Petals fleshy, yellowish green, 1-nerved, subfalcately oblong, truncate or slightly emarginate at apex, base oblique. Lip fleshy, deeply 3-lobed; lateral lobes narrow linear, acute, stiff, spreading, slightly longer than the sepals; midlobe truncately obtuse at apex, subtriangular, with the base contracted, as long as side lobes, 4 by 2·5 mm. Spur greenish, longer than ovary, slightly curved, linear and parallel to it in its upper part, twisted, slightly compressed and clavate in its lower, tip acute. Rostellum green, short but very conspicuous on account of the very large fleshy basal lobes. Connective slightly emarginate, green, cells distinct, membranous, basal folds short. Pollinia yellow with large grains, long-stalked, stalk naked (on account of the short anther-tubes); gland very long and narrow, situated on the inner surface of the basal lobes of the rostellum in channels pointing parallel to the axis of the flower; the stalk is attached to the outer part of the gland, but leaving a small free end visible from outside. Stigmatic lobes greenish, clavate, not much longer than the basal lobes of the rostellum; between them at the base above mouth of spur a small caruncle not closing the narrow opening.

The stalk of the pollinia is articulated with the gland so that, when released, the pollinia spring forward, the stalk taking its position along the longer (inner) end of the gland. An insect intruding its head between the rostellar arms would get the glands attached along the sides of its head and thorax parallel with its body, while the pollinia point straight forward.

Locality: *W. Ghats*: Khandala, in ravine (Hallberg ! in Herb. St. X.C. type).—Also in Salsette, Konkan (Hallberg !).

In bud: July.

In flower: August.

23. **Habenaria viridiflora** R. Br. Prodr. 312 Lindl. Gen. & Sp. Orchid. 319; Wight Ic. t. 1705.

Var. Dalzellii Hook. f. F.B.I. vi (1890) 150; Cke. ii, 721.—*Coeloglossum luteum* Dalz. in Kew Journ. Bot. ii (1850) 263; Dalz. & Gibs. 269.

Description: Cke. l.c.

Locality: *Konkan* (Stocks 36); Malwan (Dalzell & Gibson).—We have never seen this species; seems to be very rare.

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* Named after the late Prof. F. H. Halberg for many years our colleague.

24. **Habenaria crassifolia** A. Rich. in Ann. Sc. Nat. sér. 2, xv (1841), 72, t. 3, C; Kraenzl. Orchid. Gen. & Sp. i (1897) 344; Hook. f. F. B. I. vi, 151; Cke. ii, 722; Fischer Fl. Madras pt. viii (1928) 1471.—*Platanthera brachyphylla* Lindl. Gen. & Sp. Orchid. (1835) 293; Wight Ic. t. 1694; Dalz. & Gibs. Bomb. Fl. 269.

Description: Cke. 1.c.—In Panchgani specimens the leaves measure up to 7·5 cm., and the racemes up to 22·5 cm.

Locality: *Konkan* (Stocks, Law).—*W. Ghats*: Panchgani, Tiger Path and Fairy Spring (Blatter P72 ! 210 !, McCann !); Mahableshwar (Cooke !, Hallberg B1688 ! 26500 !, Sedgwick 7444 bis !, McCann !).—*Deccan*: Junnar Hill, near Poona (Stocks 77); Purandhar (Woodrow !, Bhide !); Singhar (Garade 57 !).

Distribution: Konkan, Deccan, W. Ghats, Nilgiri and Pulney Hills, 6,000-7,000 ft.

Flowers: Aug. 1925 (Panchgani); Sept. 1921 (Mahableshwar); Oct. 1920 (Mahableshwar).

25. **Habenaria diphylla** Dalz. in Kew Journ. Bot. ii (1850) 262; Dalz. & Gibs. Bomb. Fl. 268; Kraenzl. Orchid. Gen. & Sp. I (1897) 346; Hook. f. F.B.I. vi, 151; Prain Beng. Pl. 1031; Duthie in Ann. Roy. Bot. Gard. Calc ix, pt. 2, 185, t. 137; Cke. ii, 722; Haines Bot. Bih. & Or. 1158; Fischer Fl. Madras pt. viii (1928) 1471.—*H. Jerdoniana* Wight Ic. t. 1715.—*Liparis diphyllos* Nimmo in Grah. Cat. Bomb. Pl. 252.

Locality: *Konkan*: (Stocks, Dalzell); S. Konkan (Nimmo).—*N. Kanara*: (Law); Guddehalli (T. R. Bell 3042 !, Talbot 1916 !); Karwar (Talbot 586 !); Balikeri near Karwar (T. R. Bell 7874 !).

Distribution: Outer ranges of W. Himalaya in Garhwal, eastwards to Bengal, Chota Nagpur, Orissa, Konkan, N. Kanara, W. Coast of Madras Pres. from Kanara to Travancore at low elevations.

Flowers: July 1882 (near Karwar); Aug. 1882, 1886, 1889, 1920 (near Karwar); Sept. 1917 (N. Kanara).

SUMMARY

Cooke has mentioned 75 species of Orchids indigenous in the Bombay Presidency, classed under 31 genera.

In the preceding articles 7 genera have been added not known in the Presidency before: *Desmotrichum*, *Pachystoma*, *Calanthe*, *Chilochista*, *Saccolabium*, *Epipogum* and *Tropidia;* of species 20 have been observed for the first time in our area.

Owing chiefly to assiduous collecting in N. Kanara over a period of many years and careful notes by Mr. T. R. D. Bell, late Chief Conservator of Forests, Bombay Presidency, and helped by beautiful paintings by Miss Evangeline Bell, we have been able to describe 29 new species. Thus bringing up the total number of Bombay Orchids to 124, belonging to 37 genera. We must not forget to mention our friend the late Professor F. Hallberg to whom we have to be grateful for many valuable observations and suggestions.

We subjoin at the end a list of all the genera adopted in our paper, each with the reference to the volume and page in our series.

Key to all the genera of Bombay Orchids. (after Cooke).

A. Pollinia waxy
  I. Pollinia 4
    1. Leaves equitant ... ... 1. *Oberonia.*
    2. Leaves not equitant
      a. Terrestrial or epiphytic herbs. Leaves membranous, usually sessile. Inflorescence terminal. Flowers rather small, in racemes or spikes. Column prolonged below into a foot
        * Lip with basal auricles. Column very short with broad arms. Terrestrial ... ... 2. *Microstylis.*
        ** Lip without basal auricles. Column long with callosities or wings, or both. Rostellum sometimes double. Terrestrial or epiphytic ... 3. *Liparis.*

b. Epiphytic herbs. Leaves chartaceous or coriaceous. Column more or less prolonged below into a foot

* Stems solitary or caespitose or composed of discrete pseudobulbs basally attached on a short or long rhizome

§ Flowers from the stems or pseudobulbs, terminal or axillary, solitary, or on short few-flowered peduncles or in few- or many-flowered racemes, usually large and showy

† Rhizome short, stemless with a single pseudobulb or pseudobulbs plurinodal ... 4. *Dendrobium.*

†† Rhizome long, annulate, stem nodose, bearing uninodal pseudobulbs ... ... 5. *Desmotrichum.*

§§ Flowers from lateral scapes rising from the base of the pseudobulbs, or from the rhizome between them, solitary or in heads, umbels or racemes

† Lateral sepals alongside or under the lip. Flowers racemose or spicate or umbellate ... ... 6. *Bulbophyllum.*

†† Lateral sepals spreading. Scape 1-flowered ... 7. *Trias.*

** Stems jointed, composed of elongated pseudobulbs strung on a woody core. Flowers in racemes 8. *Pholidota.*

*** Stemless tufted herbs. No pseudobulbs. Flowers in panicles ... 9. *Josephia.*

II. Pollina 8.

1. Epiphytic pseudobulbous herbs, usually small. Inflorescence lateral or terminal, racemose or capitate. Flowers with a mentum. Column prolonged below into a foot. Lip incumbent on the foot of the column

a. Sepals connivent at the base, all or the lateral only connate. Pseudobulbs small, discoid, reticulate ... ... 10. *Porpax.*

b. Sepals and petals free. Pseudobulbs not discoid ... ... 11. *Eria.*

2. Terrestrial herbs; rhizome nodose ... 12. *Pachystoma.*

3. Epiphytic or terrestrial herbs. Stems not pseudobulbous, slender or equally thickened along their whole length. Leaves distichous ... ... 13. *Thunia.*

4. Terrestrial herbs, often pseudobulbous with a short or tall leafy stem. Leaves plaited. Flowers usually pale or dark purple ... ... 14. *Calanthe.*

III. Pollina 2

1. Stem pseudobulbous or tuberous at the base

a. Terrestrial herbs. Flowers in pedunculate racemes. Leaves plicate

* Lip distinctly 3-lobed, saccate or spurred at the base. Inflorescence strict ... ... 15. *Eulophia.*

** Lip obscurely 3-lobed, wide ventricose, but not spurred at the base. Inflorescence at first decurved ... 16. *Geodorum.*

b. Epiphytic herbs with long linear sheathing leaves on usually a large fleshy pseudobulb. Lobes of the lip embracing the unwinged column ... ... 17. *Cymbidium.*

2. Stem not pseudobulbous nor tuberous at the base

a. Column prolonged into a foot

* Spur erect or parallel to the blade of the lip, pointing forwards; lip adnate to the produced foot of the column; side lobes of lip erect; foot of column long ... ... 18. *Sarcochilus.*

** Spur saccate. Lip movable on the foot, side lobes of lip erect. Column very short ... ... 19. *Chilochista.*

*** Spur saccate, laterally compressed. Side lobes of lip 0; foot of column small ... ... 20. *Rhynchostylis.*

**** Spur conical, usually more or less elongated, erect or curved under the midlobe of the lip; foot of column large ... ... 21. *Aerides.*

b. Column not prolonged into a foot

* Lip not spurred nor saccate

§ Leaves terete. Flowers in short spikes. Caudicle of pollinia broad ... ... 22. *Luisia.*

§§ Leaves lorate. Flowers in racemes with very long simple or branched peduncles. Caudicle of pollinia long, narrow ... 23. *Cottonia.*

** Lip spurred or saccate

§ Side lobes of lip large. Flowers large ... ... 24. *Vanda.*

§§ Side lobes of lip small or 0

† Spurs 2, collateral ... 25. *Diplocentrum.*

†† Spur or sac single

¶ Spur not septate within 26. *Acampe.*

¶¶ Spur septate within ... 27. *Sarcanthus.*

¶¶¶ Spur naked within or with calli on the front wall only ... ... 28. *Saccolabium.*

B. Pollinia powdery or lamellate, never waxy

I. Anther terminal. Pollinia 2 or 4, cohering by their sides, without either gland or caudicle. Leaf solitary, mostly appearing after the flowers ... ... 29. *Nervilia.*

II. Anther posticous. Pollinia 2

1. Sepals narrow, free. Lip concave, saccate or shortly spurred at the base. Column short. Leafless herbs ... 30. *Epipogum.*

2. Lateral sepals connate, forming a mentum. Lip sessile. Column short, dense-flowered ... ... 31. *Tropidia.*

3. Dorsal sepal and petals together forming a hood. Lip sessile. Spike lax- or dense-flowered ... ... 32. *Spiranthes.*

4. Sepals free, dorsal with the petals cohering in a hood. Column without appendages. Lip adnate to the base of the column ... ... 33. *Zeuxine.*

5. Sepals connate to the middle into a tube 34. *Cheirostylis.*

III. Anther-cells sessile on the column, remote or contiguous, always discrete. Pollinia 2, sometimes 2-partite
  1. Sepals subequal and more or less connivent ... ... 35. *Peristylus.*
  2. Sepals unequal, the lateral ones more or less spreading
    a. Stigmas sessile or subsessile, confluent or more or less distinct ... ... 36. *Platanthera.*
    b. Stigmas more or less distinctly stalked, very rarely confluent ... ... 37. *Habenaria.*

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(To be continued.)

GAME FISHES

OF

BOMBAY, THE DECCAN AND THE NEIGHBOURING DISTRICTS OF THE BOMBAY PRESIDENCY.

BY

SIR REGINALD SPENCE, Kt., M.L.C., F.Z.S.

AND

S. H. PRATER, M.L.C., C.M.Z.S.

(With 19 plates).

INTRODUCTION

The present article is written as a help to anglers in the Bombay Presidency. It gives general information as to fishing localities in and around Bombay and indicates the common species of game fishes which live in our local waters. Its purpose is also to help the layman to recognise and identify his catches, and finally it suggests measures which will tend to the improvement of fishing in local waters.

Underlying this purpose there is the desire to carry the interest of the fisherman beyond the mere catching and landing of fish, to bring him ultimately to a stage where, knowing his fish, he desires to know something of its life and its habits and to understand and appreciate those factors which influence the living creature within its particular environment.

The Zoologist has too often concentrated his study on dead specimens in museums, or experimented with living creatures only in his laboratory. By these methods he has accumulated considerable data essential to the continuance and development of his researches. But the problem of Life which he seeks to unravel cannot be unravelled in the museum or laboratory alone. The Zoologist is therefore turning more and more from the museum to the field, and his greatest help now, as in the past, is the field naturalist who is able to appreciate the problems which require study, and who knows the most suitable and effective methods by which these problems can be approached.

An indication of the various phenomena affecting the life and characters of fishes or the methods of their interpretation, does not fall within the limited scope of the present article. Our object is rather to provide information which will be the means of developing a wider interest in the subject and to obtain from anglers that assistance and co-operation which will increase our knowledge of the fresh-water fishes of India.

At the outset we acknowledge our indebtedness to Mr. F. V. Evans, a Vice-Patron of the Society and one of the original members of what was once the Western India Angling Association.

Since his retirement many years ago Mr. Evans has continued his interest in Bombay. He has originated, or willingly lent his support to, schemes which would tend to the improvement of its amenities. He has interested himself in various activities of the Society, helped it very substantially by numerous valuable contributions to its library and by generous donations which have contributed very materially to the progress and development of the Natural History Section of the Prince of Wales' Museum, where the Society's collections are now exhibited. Among other exhibits in the Museum, the public of Bombay are indebted to him for the fine series of cases and their range of models illustrating the Marine and Fresh-Water Fishes of India now on display in the Fish Gallery of the Museum.

The idea of the present article originated with Mr. Evans who supplied the notes to form its basis; who also very generously offered to provide the not inconsiderable sum of money required for the coloured illustrations. In view of this outlay the Editors believed that it would be advantageous considerably to extend the scope of the article until it reached its present form.

We have also to acknowledge the assistance received from various members of the Society, all of them men with much experience of fish and fishing round Bombay. Our thanks are due in particular to Major W. B. Trevenen, now Honorary Secretary of the C.P. Angling Association—an enthusiastic fisherman and field naturalist whose experience is always at the disposal of anyone interested in a sport which he has done and is doing so much to develop in this country and whose paper on 'Fishing in the Deccan Lakes' published in Volume xxx of this Journal has been of great help to fishermen in Poona. Information relative to fishing conditions in the waters about Igatpuri was supplied to us by Lt.-Col. Sir George Willis—while the opportunities afforded by the rivers of Surat and Ahmedabad districts were indicated by Mr. P. H. Clark. To these gentlemen we offer our tribute of thanks and appreciation.

While the present work is mainly limited to species which occur in the Bombay Presidency, it is hoped that it will also be found useful to anglers in other parts of India since the majority of species dealt with are found practically throughout the country.

ILLUSTRATIONS AND LITERATURE.

The illustrations of the Fishes have been produced in colours as giving more accurate knowledge of the various types than would be the case were the line-drawings only published.

Unfortunately, fresh specimens of fish were not available to paint from, and our artist was compelled to rely on colour descriptions as given by Day and other authorities.

We acknowledge our indebtedness to Lt.-Col. Thomas and to Messrs. L. Reeve & Co., Henrietta Street, Covent Garden, London, for permitting us to reproduce certain illustrations from the *Rod in India*, (Thomas, 2nd. edn. 1881) and the *Fresh-Water Fishes of India* by Capt. R. Bevan, 1877.

The description of Fishes which follow are based mainly on

Day's two Volumes on Fishes in *the Fauna of British India* series. The following is a list of literature consulted by us:—

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Thomas, H. S., 1881. *Rod in India*, 2nd. edn. (Thacker Spink & Co., Calcutta.)

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I

FISHING LOCALITIES IN AND AROUND BOMBAY

The opportunity for sport offered to anglers by the various irrigation lakes and reservoirs, rivers and streams in the immediate neighbourhood of Bombay and in the neighbouring districts has received little attention from writers on this branch of sport.

There are three lakes in Salsette which Island forms part of Greater Bombay. These are Tulsi, Powai and Vehar. Moderate sport may be had in the streams which flow from Powai and Vehar lakes or in the lakes themselves during the monsoon. Black Spot and Chilwa are fairly plentiful. One can bait with almost anything, worms, paste and coloured fly, in all cases using small hooks. Mr. E. G. Edgley who has had considerable experience of fishing in the local lakes and streams writes, 'A typical day's fishing in the streams or in Powai Lake is as follows—7 a.m. the fish rise well to a small spoon (about the size of a pea). They may rise well for an hour or two and you think that you have taken all the fish in that particular stretch, but try a black or a red fly. The chances are that on a good day the fun will start all over again. If they do not favour a black or red fly, ring all the colour changes on them. A good day has rewarded me with 80-100 fish from ½ lb. to a few ounces. The best Chilwa I have seen, taken out near the Pump house, measured over 8 in.'

Fifty-five miles north of Bombay at the foot of the Western Ghats lies the Tansa Lake. It covers, when full, an area of 5½ square miles and with Tulsi and Vehar provides the water-supply of Bombay. There is a large lake at Bhiwandi 29 miles north of Bombay and 10 miles north of Thana, approached by the Agra Road.

Lake Beale, situated between Ghoti, the first station after Igatpuri, and Asvali, the second station, is 17 miles in length.

Thirty-four miles eastward of Igatpuri, close to Niphad station on the G.I.P. Railway, is a lower lake, fed by the waters of Lake Beale, conveyed by the River Darna. Twenty-six miles southward of Igatpuri lies Lake Arthur Hill formed by the great Bhandaradara Dam.

In the Bhor Ghat area, there is the lake in the Andhra Valley, and in the neighbourhood of Lonavla the Shirvata Lake, the Walwan Lake (Lake Sydenham) and Lake Gostling. This last is dry except during the monsoon. Walwan, once an excellent resort for anglers, may now be very disappointing. It is the opinion of many who have had experience of this lake that it has been over-fished. A few years ago one could always come away with one or two 10 or 15 pounders. One fished from the dam. The bait used was paste made from bajiri and wheat flour. One had not to wait long for a strong pull. Good fishing could be had also from the boat with a rather dull spoon about 2 in. long. The best time was from 6 p.m. till 8 p.m.

At present the bait most used is an Indian concoction known as 'Budgas' made from gram flour and available at most of the sweetmeat shops in the local bazar.

The most suitable tackle for fishing in Lake Shirvata is a dull spoon. If a boat is available troll fairly slow. If there is no boat walk up and down the dam trolling both ways. There are plenty of fish, both Dobson's Carp and Wallago.

In the neighbourhood of Poona, there is Lake Fife at Khadakwasla. Within the Poona city limits there is that stretch of water on the Mutha-Mula River held up by the dam which is known as the Bund. There are certainly many big fish there, particularly in the backwaters of the Island, about a mile upstream. Fish which would scale quite as much as 50 lbs. may be seen turning over near the surface, but they are rarely caught. It is easier to catch the smaller fry. A regular course of baiting with gram has been suggested as a preliminary to taking the bigger fellows. Further down, a mile below the Bund, there is a drop in the river known as the Cavalry Falls. This is a good spot particularly after the rains when the larger fish have dropped down with the receding water. Big fish are found here also during the hot weather. A Mahseer (*B. tor*) weighing 25 lbs. and 2 others scaling 22 and 23 lbs. were taken at the spot recently, during the month of March. At Bhoopkeel, near Kirkee, a large pool, which teems with fish, is formed in the river by a masonry dam, situated near the Ammunition Factory. Three miles north of Shelavadi Station on the Lonavla-Poona line and midway on the road between the station and the village of Dehu, near the 'two-tree Temple' there is the famous pool formed by the river Indrayani. The pool is sacred, and fishing in it is forbidden. It swarms with great fish which beat up the water and crowd together to feed on the monkey nuts which people throw to them. Local belief has it that all the fish in the stream move to Alandi ten miles below when the annual fair is held there. It is possible that some such movement takes place owing to the food thrown into the river during the fair; as experience has shown that there always is a congregation of fish at the spot during the festival and very few at other seasons.

Lake Whiting at Bhartgarh, formed by the 'Lloyd Dam' and also the River Nira, which carries off its overflow, provide good sport. Spoon fishing is recommended here, particularly at the rocky runs of the river near 'Ing' two or three miles below the lake. A good time is just before the rains.

There is hardly a river of any importance in the Deccan which is not crossed by at least one ancient or modern irrigation weir. On some of these there are many weirs, all of masonry, sometimes very lofty. Similarly, the tributary streams during the whole or part of the dry season are crossed by many little dams, usually built for the season only, of wattle, mats or mud and gravel, at times of good stone work. But the greater number of these are reduced to mere puddles, or entirely dry up during the hot weather. The best season for fishing in the Deccan *Rivers* is during the cold weather, as soon as possible after the rains, before the dry season has lasted too long, in which case the waters recede and become discoloured by pollution. Many of the rivers and streams are however now perennial as a result of dams, such as the Darna river, which is fed by Lake Beale, and the Pravara by Lake Arthur Hill. There are 14 miles of the Pravara river immediately below the dam which would make an ideal fishing river. Its waters hold Mahseer running from 20 to 25 lbs., also Chilwa and Murral. The scenery is wonderful. The main disadvantage is that it is 21 miles from the nearest railway station Ghoti, and 50 miles by road from Nasik. Chilwa have been taken with a small black fly in the Darna below the Lake Beale Dam, many of them exceeding 9¼ ins. in length and weighing over 3 ounces. At the Darna Dam they give excellent sport with a light rod when but little water is being let down and the Mahseer fishing, except in pools with gram, is hopeless. The Darna also contains *Barbus sarana* running up to about ¼ lb. and many of those tiny transparent perches which can be caught on midge flies. *Wallago attu* is common and runs very large as it does also in Lake Beale. It is unknown in Lake Arthur Hill and in the Pravara above Sangamner but is probably common below the latter place.

As regards the season for *tanks*, these can be fished as soon as the waters clear after the rains, but the best season of all is, at any rate for a certain number of them, during the hot weather up to the beginning of the high winds just before the monsoon, at which time all the best fish congregate towards the lower waters, and appear to be much more ready to take a bait. Lake Fife, at Khadakwasla, is a noted example of this fact. In some tanks, which have clean, hard and steep banks, such as Walwan at Lonavla, one can catch fish even during the monsoon, but they are in very poor condition then and full of spawn or milt, and should be left alone at that period. Major Trevenen gives the following information as regards other localities in the Deccan and Southern Mahratta country:—

R. Bhima, near Patas (40 miles from Poona on Poona-Sholapur Road). Here a boat is required. There is a large deep pool near Nangaw or 'Nandgaon' in which one should troll with a spoon 3 ins. long. The fish will also take paste.

R. Gatprabha (Tributary of R. Kistna). At Sutgatti, 17 miles from Belgaum, holds fish up to 20 lbs. Season is from after rains to end of January. Use a 2½ ins. hog-back spoon with Punjab trace. A Fly spoon and gut trace is useful for the smaller fish.

Gokak Falls. (Belgaum District). Season any time as long as the water is gin-clear. Time, morning or evening. Try right under the Falls in the big pool and also where the water comes through the turbines into the pool. It is no use fishing here when the turbines are not working. The water is then too dead. Mahseer up to 38 lbs. have been caught here. There is a bungalow at Dhupdal Tank about 3 or 4 miles away.

Rivers Pandri and Tarwa. At Astoli, 3 miles from Londa Station (M. & S. M. Rly.). Time, during a break in the rains after the water has cleared. Fish from the road bridge between Londa and the turning-off to Astoli or Tinai Ghat road to a spot about 4 miles down-stream. Use a hog-back fly spoon. Fish run up to 12 or 14 lbs. The scenery is delightful.

Khandesh, from the fisherman's point of view, should be similar to the Bombay Deccan as it is very similar both as regards the nature of its rivers and tanks and also as to the geological formation of the country.

If the fisherman tires of the local streams and lakes and requires a change of surroundings the rivers and streams of the Surat District, a few hours by rail from Bombay, will offer him a new field for his enterprise. The Parr River is only 4 miles from Bulsar station. A motor bus runs out to the River. The Kolak River is about 2 miles south of Udvad station; Mahseer, Murral, *Wallago attu* and large numbers of Rohu are to be had in these rivers. The Daman Ganga River flows 1½ miles south of Daman Road station. Its upper reaches, a few miles above the railway bridge, are full of freshwater and estuary fish. About two miles below the railway bridge, near the Salt Inspector's Bungalow, estuary fish abound and can be taken with spoon. Just after the monsoon is the most suitable season for working this stream. The Sanjan River, a mile south of Sanjan station, contains numerous estuary fish. A mile and a half to two miles down the stream there is a magnificent stretch of water which is under tidal influence. High tide is, of course, the most suitable time to fish this stretch.

Ahmedabad, further north, offers opportunities to the angler. After the monsoon, when the river Subermati clears, Mahseer are to be caught close to the Railway bridge. At Khedbrahma, a station on the Ahmedabad-Prantij Railway, wonderfully good fishing is to be had in one of the tributaries of the Subermati River. Mahseer, running up to 8 lbs., Murral and *Wallago attu* are numerous. Near the village of Wassin-Baroda, 34 miles from Ahmedabad along the Kaira Road, some of the finest fishing in India is available in the Subermati River. To obtain good results in any of these streams long casting is essential. By long casting is meant casts of at least 30 to 40 yards.

II

The Commoner Local Game Fishes.

THE CARPS.

The Mahseer.

Nearly all the fishes of any importance to the angler belong to two families—the *Cyprinidæ* or Carps and the *Siluridæ* or Cat-Fishes. We commence with the Carps. The fish best known to the disciple of the Rod in India is the Mahseer. Which fish goes by this name? Perhaps it would be correct to say that no fish has an exclusive right to it. Naturalists have appropriated the name for the giant of the tribe, *Barbus tor* (Ham. Buch.). Fishermen frequently apply it to any of the larger examples of predatory barbels of the genus *Barbus*. Vernacular names are equally confusing in their application. Dr. Day gives the Marathi names *Khadchi* and *Masla* under *Barbus tor*. In a list of the Fishes of the Poona District, Mr. H. Wenden gives *Khadchi* and *Masla* as the Marathi terms for Jerdon's Carp (*Barbus jerdoni*). *Kursi*, according to Major Trevenen, is another name by which the Mahseer is known around Poona. Dr. Fairbank gives *Mahasala* as the vernacular name of *Barbus tor* in the Deccan. Mr. MacIver, who has had much experience of fishing in the neighbourhood of Satara, says in this locality *Barbus tor* is called *Kudis*. Anglicised versions of Marathi names will naturally differ in their interpretation, and it is possible that some of the names we have mentioned are different renderings of the term *Kawli Massa* or 'Scaly Fish' in allusion to the large scales. It is a name which is generally applied in the Mahratta Country to the large-scaled barbels of the Mahseer group. It should not be assumed that such names as are ascribed are the vernacular names in all the districts where Marathi is spoken. Fishes throughout the world appear to have more local names given to them than any other animal.

The Mahseer (*Barbus tor*), or more correctly, a form or race of this species, occurs in the streams and lakes of the Bombay Presidency. We have even seen an example of *Barbus tor* taken in the Parr River near Bulsar in water well within tidal influence. But our rivers and lakes do not produce the big fish of North or South India. The reason for this is simple. The streams of the Deccan are in flow for only 3 or 4 months of the year and the sources of nearly every one of them are, and have been for many generations, in rice fields out of which few spawning fish and not many fry escape alive. Circumstances are against large fish, like *Barbus tor*, with a taste for high spawning grounds, while they favour fish of smaller size though otherwise similar in appearance and habit. Again, Mahseer, like crocodiles, living in the still waters of a lake do not appear to attain the size and vigour of their relatives in rapid rivers. Apart from size, the Mahseer of our streams are said to differ from those of North and South India. It is believed that they belong to an undescribed race or races. On the other hand, a fisherman with experience of fishing both in the Himalayan waters and those of the Deccan, maintains that the Mahseer of the Deccan streams are identical with those of the Kumaon Lakes and Rivers. Careful comparison by him of Mahseer caught in Kumaon with those taken in the Darna and Pravara Rivers revealed no difference or rather no more difference than often exists between individuals caught in the same stream—differences which can be accounted for by individual variation.

It is not yet possible to discuss the races or even the species of fish now known as *Barbus tor*. Possibly 6 or 7 different forms or even species of this fish may inhabit the Indian Empire.

Barbus mussullah, originally described by Sykes, is found in the Krishna and its tributaries about Satara and very probably in other Deccan streams. It may be a distinct species or merely a form or race of the Mahseer. It differs from the Mahseer in the structure of its mouth which is much more oblique than in *Barbus tor*. The extremity of its upper jaw lies in a direct line under the centre of its eye (see Plate II). It is a common fish in the upper waters of the Krishna where it lives in company with the Mahseer. The local fishermen call it *Masundi*. A specimen, weighing 21 lbs., was caught by Mr. M. MacIver.

To discover the various races of *Barbus tor* and to know something of their distribution it would be necessary to examine a large series of specimens collected from various parts of India at different seasons of the year. One obstacle to collecting these Barbels is that their size makes preservation difficult. But with a will to do so, anglers can help very materially in solving this problem.

Other species of Barbus.

We now come to another group of Barbels about which, as with the Mahseer, much confusion exists. It is doubtful how far the term 'Carnatic Carp' can have a scientific basis. Many species so called have no more than a distant resemblance to *Barbus carnaticus* of Jerdon. Besides, Jerdon limits the distribution of this fish to South Kanara, the Nilgiris and the Wynaad. The species, which go by the name of Carnatic Carp in the Deccan, are in all probability *Barbus jerdoni* (Day) and *Barbus dobsoni* (Day). Though Day recognises them as distinct species, these two fishes are probably varieties or local races of one and the same species. Differences in the number and size of the scales serve to distinguish the two forms. A third variety, described by Annandale under the name of *Barbus jerdoni maciveri*, was discovered in the Krishna River near Satara. The Maharata name for it is 'Purgi'. Mr. MacIver, after whom this race was named, refers to it as the 'Carnatic Carp of the Krishna'.

Various other members of the Genus *Barbus*—small and large—occur in our lakes and streams. Day lists 70 different species as inhabiting the Indian Empire. He divides them into three main groups—those with four barbels, those with two, and those with none at all. Besides the Mahseer and the races of 'Carnatic Carp' to which we have referred, there are five other Barbels in our area which belong to the first group. *Barbus sarana* (Ham. Buch.), which grows to about 2 feet in length, is a common fish, liable to much variation in different localities. It is described as the most sporting Barbel in Gujerat where it is known as the 'Darai'. The Marathi name is 'Kudali or Pitule'. The Olive Carp (*Barbus chrysopoma*, Cuv. & Val.), occurs in the Deccan streams—it is one of the Barbels which can be used for stocking ponds. *Barbus pinnauratus* (Day) is referred to as the 'Mahseer' of the Konkan where the true Mahseer is said not to occur. Day mentions 10½ inches as the length of the largest specimen. Yet Sinclair mentions examples scaling 10 lbs. He writes that as a sporting fish 'it is equal to any Mahseer weight for weight'. Whether *Barbus pinnauratus*, *chrysopoma* and *sarana* are really distinct species or merely forms or races of one and the same species is open to question. Day himself is inclined to the belief that *Barbus pinnauratus*, is a variety of *Barbus chrysopoma;* while *Barbus sarana* is very similar to both of them. It is only by examination of a good series of these fishes that the problem can be decided. Buchanan's Carp (*Barbus curmuca*), whose distribution is given by Day as the Western Ghats, is said to grow to at least 4 feet in length. The Malabar Carp (*Barbus malabaricus*, Jerdon), which Day limits to South Kanara and Travancore, has also been taken in the Satara District. It grows to about 1½ feet in length.

There are two species of *Barbus* in our waters which belong to the two-barbelled group. *Barbus parrah* (Day), known as the Kudali, is common about Poona. It grows to 6 inches. *Barbus kolus* (Sykes), the 'Koolis' or 'Koolashi' reaches over a foot.

The last group—without barbels—contains mostly small fish useful mainly for stocking tanks. There are 3 local species. *Barbus ambassis* called 'Bhondgi' in the Poona District favours tanks and still water. It breeds in December and the young will be found mostly in January. The Black Spot (*Barbus filamentosus*, Cuv. & Val.), is much valued as food, it grows to about 6 inches; while the third species *Barbus ticto* (Ham. Buch.) does not exceed 3½ inches.

The Rohu

Besides the genus *Barbus*, the Carp Family (*Cyprinidæ*) includes various other genera which interest the angler. Noted members are the Rohu or Roho Fish (*Labeos*). The name Rohu is as indiscriminately used as the term 'Mahseer' or 'Carnatic Carp.' Various species of *Labeo* are called Rohu. These fish are easily distinguished from the tribe of *Barbus* by their much deeper and thicker bodies and very peculiar mouths set under the snout and furnished with thick, warty lips. *Labeo rohita* (Ham. Buch.), called in Marathi *Tambada Massa* or Copper fish, attains 3 feet in length and may scale over 50 lbs. in weight. Five other species of *Labeo* are found in the Deccan streams. *Labeo fimbriatus* (Bloch), for which Day gives the Marathi name *Tamba*, grows to 1½ feet in length; a fish of this species, scaling 25 lbs. measuring 23 ins. in length was caught at Poona in 1923. *Labeo calbasu* (Ham. Buch.), known as the 'Kanoshi', grows to 3 feet. The 'Nakta' or 'Nakta Shendwa' (*Labeo nukta*, Sykes), is not much over a foot. Two other small species inhabiting our streams are *Labeo porcellus* (Heckel) and *Labeo kawrus* (Sykes). The *Labeos* are essentially bottom-feeders living on minute crustacea and vegetable matter.

The Chilwas.

The bright silvery *Chilwas* are small, flat-sided, thin-bodied fish with the stomach running to a fine edge and the dorsal fins set far back. Three species are recorded by Day from the Deccan. *Chela clupeoides* (Bloch), called in Marathi the 'Alkut', is said by Day to grow at least 9 inches in length, but Thomas in his 'Rod in India' indicates that it may grow up to 18 inches in length and a hand's breadth in depth. As stated previously, in the Darna River there are many which exceed 9 inches in length. *Chela bacaila* (Ham. Buch.), for which the Marathi name is 'Dantal', attains 7 inches and *Chela phulo* (Ham. Buch.), the 3rd. species, not more than 5 inches. To these we must now add a 4th. species *Chela boopis* (Day), which Day limits to Mysore and South Kanara but which has been taken in the Krishna at Satara. The *Chilwas* are remarkably active in the early mornings and evenings which means that they are thoroughly on the feed then. During the middle of the day, they seem to favour deeper water, become less active; occasional rises being seen in the centre or deeper parts of the pool but no regular feeders.

The Mirrgha and the Catla.

The Mirrgha (*Cirrhina mrigala*, Ham. Buch.), a fine fish of elegant appearance with bright golden scales, grows to 3 feet in length and may scale 18 lbs. It is described as an excellent species for stocking tanks. *Cirrhina reba* (Ham. Buch.), another species, may be seen basking frequently on the surface of still pools with their snouts showing above water. It is then hopeless to fish for them. They not only refuse to take any bait offered to them but show no alarm and ignore any small lure such as gram or a small piece of paste thrown in their midst. Day lists 5 species of *Cirrhina* all of which are found in the Deccan streams. They are handsome Carps, good for the table and if one can get them to take either fly or bait, they give better sport than any other Indian fish as they certainly have no equals in grace or form or motion.

The last-noted member of the family, which lives in our waters, is the Catla (*Catla catla*, Cuv. & Val.), better known as *Catla buchanani*. This is a strong and active fish frequently used for stocking tanks. It grows to 6 feet and is recorded as having been taken up to 100 lbs. on a rod. So much for the Carps.

THE CAT-FISHES.

The *Siluridæ* or Cat-Fishes, though not so numerous in individuals as the Carps, are quite as often in evidence while several of them make much better fare for the table than any *Cyprinidæ*. Among anglers, the best-known member of the tribe is perhaps

Wallago attu (Bl. Schn.). It is the commonest and the best eating. 'Shivada' and 'Pari' or 'Padi' are the Marathi names for it. *Wallago attu* grows to 6 feet in length but this is exceptional; specimens over 4 feet are rare. Sluggish in movements, it lives mostly at the bottom, feeding on animal and vegetable matter. In the early morning or late evening they may be seen on the surface in pursuit of small fish when they occasionally will take spoon as well. *Wallago* are very destructive to fry and smaller fish in ponds.

Another noted member of the tribe and very similar in habit is the Goonch (*Bagarius yarrellii*, Ham. Buch.), known by the names 'Mutauda' and 'Tharota' in Marathi. Like *Wallago attu*, it grows up to 6 feet and many scale from 200 to 300 lbs. The term Singlala or Singhata meaning 'horn-fish', probably in allusion to the spines with which some of these fishes are armed, is applied generally to various Cat-fishes mostly members of the genus *Macrones*. They generally give good sport and are good eating. The best way of angling for them is to use live bait, the best time is the evening when they leave deep water to forage along the banks. Failing live bait, raw meat answers fairly well. It is necessary to be careful in handling Cat-fish as some of them are armed with sturdy, poison spines which can inflict a painful slow-healing wound. One of the most poisonous of these cat-fishes is *Saccobranchus fossilis* (Bloch.), whose vernacular name, 'Bitchu-ka-machi' or Scorpion Fish gives a fair idea of its local reputation. The larger species, like the Goonch and Wallago, are commonly called 'Fresh-water Sharks'.

THE MURRALS.

There is yet one family of fishes which interests anglers and that is the *Ophiocephalidæ*, which means Snake-headed, in allusion to the scales which cover the heads of these fishes. It includes the Murrals. Day lists 9 species the majority of which are found in the plains. *Ophiocephalus striatus* (Bloch.), in Marathi the 'Dakhu' is one of the largest and most valuable of food fishes of inland waters. Being an air breather, it is transported with ease and admirably suited for stocking tanks and lakes. Care should be exercised in introducing it into preserved waters as it is voracious and is very destructive to fry. The White-spotted Murral (*Ophiocephalus leucopunctatus*, Sykes) is common in the Deccan. Day gives the Marathi name as 'Maral'.

The *Ophiocephalidae*, having hollow cavities in their heads, and an amphibious mode of respiration, are able to exist for lengthened period out of their native element, and can travel some distance over the ground especially when it is moist. They are also able to live in the sun dried mud of a tank during the dry season. Observations on such habits which are verified by the angler are of the greatest value. Observations on the breeding habits of the Murral, nest building, parental care, would prove of much interest.

The above summarises the more important game fishes of our lakes and rivers. It will be seen from what has been written that our knowledge of the various species, their range, the variations in form and structure which they exhibit in different areas and under different conditions of life, is very rudimentary. Knowledge of this nature can only be acquired by the examination of series of specimens collected at different places in different seasons. The difficulties of doing so are not insuperable. The Natural History Society is always willing to help anglers with information and advice as to how this can be done. Equally rudimentary is our knowledge of the life and habits of the various fresh-water fishes, their breeding and early stages of development. This is another avenue in which fishermen can help—by noting down any observations they make.

All observations that anglers can make relative to sex, mode of propagation and development of fishes will be of the greatest interest. Information is wanted on time of spawning and migration, mode of spawning, construction of nests, care of progeny, change of form during growth. Other points to be noted are secondary sexual differences (hermaphroditism whether normal or abnormal), the numeric proportion of the sexes. Every opportunity of observing the development and tracing the stages of growth of young fishes should be taken advantage of.

The question of improvement of the fish supply of our lakes and reservoirs by the introduction of new forms or restocking, is one which naturally interests all fishermen. But this can be achieved best by co-operation, by the forming of an Association. The Western India Angling Association, which was formed some years ago by a number of keen fishermen in Bombay, is now unfortunately defunct. But enthusiasts are not wanting and the revival of the Association is not impossible if anglers would get together and discuss the ways and means.

We indicate in the course of this pamphlet some of the species of fish most suitable for the purpose of stocking tanks and reservoirs in the hope of helping those who are interested.

III

How Fishes are Identified.

As with other classes of the Animal Kingdom, Fishes are divided into various Orders, Families, Genera and Species. Sharks and Skates are distinguishable from all other forms of fish. They are grouped together in a single *Order*. Now while Sharks and Skates have certain structural resemblances in common, they exhibit other characters by which they may be differentiated. Hence we have two subdivisions of the Order, in other words two *Sub-Orders*—one to include all the Sharks, the other the Skates and Rays. The *Family* is a further division of the Order or Sub-Order. Sharks vary among themselves in form and structure and again some of them have certain characters in common. The purpose of the Family is to group together those sharks which bear these family resemblances so as to distinguish them from other sharks which do not share these features. The members of a family are again divisible into various *Genera.* From general resemblances we come here to more particular affinities shown by a more or less limited number of members of the Family. To specify these affinities we establish a Genus or genera and group together in each genus the various members of the family in accordance with the affinities they exhibit. Finally, the members of a particular genus are recognizable one from the other by specific differences. These differences may be indicated in the structure of the teeth, in the position of the fins, in the number and arrangement of the scales and in any one character or combination of characters by which a particular species may be recognised. Thus we have distinctive *Species* and we may go even further and distinguish a particular species of fish living in a given geographical area from another of the same species inhabiting the waters of another area. Thus the Mahseer of the Deccan streams may differ from the Mahseer of the Himalayas and it, in turn, may be distinguishable from the Mahseer of the South Indian rivers; we would thus have various forms or *Races* of the Mahseer.

It will be seen that the classification and identification of fishes is based on resemblances or differences in their structure and anatomy. The recognition of these essential points of difference is beset with technicalities, and a knowledge of the subject can only be acquired after careful study. An endeavour is made here to indicate the main external characters on which these differences are based and to explain the more common terms and abbreviations used in technical descriptions of fishes.

Form of Body. In general, fishes are boat-shaped and adapted for swift movement through the water. They are longer than they are broad or deep. But there are many variations from the typical form. In some fishes the body is deeper than long. In others it is extremely lengthened. The body of a fish is said to be *compressed* when it is flattened laterally as in some of the Carps. It is described as *depressed* when it is flattened vertically as with some of the Cat-fishes. The body may be eel-like (*anguilliform*) or globular (*globiform*) or ribbon-like (*tæniform*) or shaped like a dart (*sagittiform*).

The head. All characters of a fish vary a good deal, so that one individual cannot be taken to represent the species or race. The head of a fish is its most variable part, for it comes under varied influences. It is the wedge which cleaves through the water, moved forward or swung from side to side by the muscular body. The pressure of the surrounding water has helped to mould its surface according to the speed of the movement. Most remarkable variations in shape have arisen under these influences.

The mouth of fishes exhibits as many variations as the body; variations adjusted to the nature of its food and the method of obtaining it. It may be narrow and pointed or an extremely wide cleft reaching the hind margin of the head. It may be pointed upwards or downwards, semi-circular, or semi-elliptical or straight. If situated in front of the snout—the natural position—it is described as (*anterior*), and if it is on the upper surface of the head (*superior*); on the lower surface (*inferior*), and when extending on each side (*lateral*). Round the mouth there may be fringes of skin or barbels. These are organs of touch. With their aid a fish can 'feel' for its food without seeing it.

The nostrils lie above the snout as a rule; they have two openings.

The eyes of fishes are usually large. Sometimes they lie close together on one side, as in the Soles, or on the top of the head, but as a rule they are separate. The sockets of the eyes are called the *orbits*. The space across the forehead between the eyes is called the *inter-orbital* space, that below the orbit the *infra-orbital* or *sub-orbital* region.

Gill-covers. At the side of the fish's head, below the mouth is the large movable gill-cover—supported by a number of bones moved by muscles which cause the gill to open and shut. The supporting bones are known as *opercles*. They are named as follows:—The *operculum* forms the posterior margin of the gill-opening. The *sub-operculum* and the *inter-operculum* lie along its inferior margin. The *pre-operculum* is a semi-circular bone, usually free posteriorly, often with a serrated or spined margin. It is situated in front of the gill-opening. The margin of the gill-cover is provided with a cutaneous fringe in order more effectively to close the gill-opening. The fringe is supported by one or several bony rays which are referred to as *Branchiostegal Rays*. In abbreviated descriptions of Fishes, the branchiostegal rays are referred to as B and the Roman numerals appearing after the letter indicate the number of rays, i.e. B. iii in the description of the Mahseer means that the fish has 3 branchiostegal rays. These rays are not easy for the novice to locate as they are situated under the membrane on the inside of the lower and posterior edge of the gill-cover. They must not be confused with the *branchial arches* which support the gill rakers and the *branchial laminae*, i.e., the actual fringed portion of the gills with its bony supports through which the water is sifted.

Fins. The fins of fishes are divided into two groups:—Paired fins and vertical fins. The paired fins consist of a pair in the forepart of the body: one on each side called the *Pectorals* (P) and a second pair below the pectorals on the lower surface of the fish called the *Ventrals* (V). Either or both these pairs may be absent in fishes. They serve little use in movement through the water and are mainly balancing organs. The fin on the middle line of the back is called the *Dorsal* (D). In some cases there may be two distinct dorsal fins, either adjoining each other or separated by a small or considerable space. Very often the posterior dorsal fin consists of adipose tissue only and has no spines or rays. In abbreviated descriptions of such fishes the details relating to the two fins are divided by a vertical line. Example. D (1/6) / O.

The tail fin is the *Caudal* (C) and the one in the middle line of the belly the *Anal* (A). The Dorsal may be divided into 2 or even 3 fins, the anal is sometimes so divided.

The rays which serve to support the fins may be either *simple* or *branched*. Branched rays are always articulated. That is, they are composed of numerous joints which render them flexible. The majority of our fresh-water fishes, the Cat-fishes and the Carps, belong to an Order one of the main distinguishing characters of which is that in these fishes all the fin-rays, with the exception of the first dorsal and the first pectoral ray, are articulated. These articulated or jointed fin-rays are described as soft rays while those which are neither jointed nor branched are called *spines.* Some spines may however be quite soft and flexible. The lack of joints is what distinguishes a spine from a ray.

The foregoing description will help the angler to understand the method and the abbreviations used in describing the fins of fishes. The Mahseer's fins and rays are described as follows:—

B. iii. D. 12 (3/9). P. 19. V. 9. A. 7-8 (2-3/5). C. 10.

A reading of this description would indicate that the Mahseer has 3 branchiostegal rays; that the dorsal fin (D) of the Mahseer is composed of 12 rays of which 3 are spines and 9 are soft rays (3/9). Similarly with the anal fin (A):—A. 7-8 (2-3/5) means that the anal fin is composed of 7-8 rays of which 2 or 3 may be spines and the remaining 5 are soft rays. P. 19, V. 9 and C. 10 indicate the number of rays in the pectoral, ventral and caudal fins and that they are all of the same kind, no spines being present.

Lateral line. The lateral line consists of a series of perforated scales running along each flank in most of the bony fishes. It consists of a canal or tube sunk into the skin and opening to the exterior by a series of pores, which can be seen when the scale is examined. There is a group of sensory cells beneath each pore and these serve to give the fish impressions of minute differences in the pressure of the currents of water. In descriptions of fishes the lateral line is referred to as L. 1. The numerals printed after these letters serve to indicate the number of scales along the lateral line, counted from the head to the base of the tail. For the Mahseer the formula is given as L.1. 25-27—meaning that there may be from 25 to 27 scales along the lateral line. L. tr. represents the number of transverse rows of scales between the middle line of the back and the abdomen. These rows are usually split up into 2 groups:—Scales above and scales below the lateral line. L. tr. 4/4 means that there are 4 rows of scales above and 4 rows below the lateral line. In counting these rows it is usual to count from the lateral line to a point in front of the dorsal fin and from the lateral line to the ventral fin. The number of rows of scales between the lateral line and other points of the body of fishes are also used as a guide to their identification. Thus in the Mahseer there are 2½ rows of scales between the lateral line and the anal fin and there are 9 rows of scales along the line counting from the head to a point immediately below the commencement of the dorsal fin.

Measurements of Fishes. As most fishes grow as long as they live the actual length of a fish is not of much help in its identification. The essential point is not the actual length but the relative lengths of different parts of the body. The usual method of arriving at the length of a fish is to measure it from tip of the snout to the base of the tail fin. With this length, the greatest depth of body, the length of the head, and the length of the other parts are compared. Thus in a technical description of the Mahseer (*Barbus tor*) one reads that the length of the head is contained from 4-5 times and its greatest depth $4\frac{1}{3}$-$5\frac{1}{2}$ times in its total length. Again the length of the muzzle, the diameter of the eye and the other dimensions may be compared with the length of the head. In a Mahseer the diameter of the eye is contained $6\frac{1}{4}$-$7\frac{1}{2}$ times in the total length of the head. It should be remembered that these measurements apply in general to specimens that have reached a fair stage of development; young fishes have proportionately larger eyes, more slender bodies and larger heads than the adults.

Weighing Fishes. There are various formulæ for estimating the weight of fishes. The one most generally accepted is that proposed by G. H. Lacey and Dr. E. Cretin in the 'Angler's Handbook'. It reads as follows 'First take the length and girth of the fish in inches: add together the length and one-third of the length: multiply the result by the square of the girth, and divide by 1000 and the result will be the weight of the fish in pounds.' The formula may be abbreviated thus:—

$$\frac{(L+\frac{1}{3}L) \times (G)^2}{1000} = W.$$

In Volume xxx, p. 711 of the Society's *Journal*, Major W. B. Trevenen refers to tests carried out by him with the above formula in relation to measurements of 40 fishes taken in Lake Fife, Poona. It was found in every case that the result was an error *in excess*—the actual amount of error increasing more or less with the size of the fish. Slight alterations in the formula resulted in greater accuracy. Finally the formula was modified by him as follows:—'$\frac{1}{4}$ the length' was substituted for '$\frac{1}{3}$ length'.

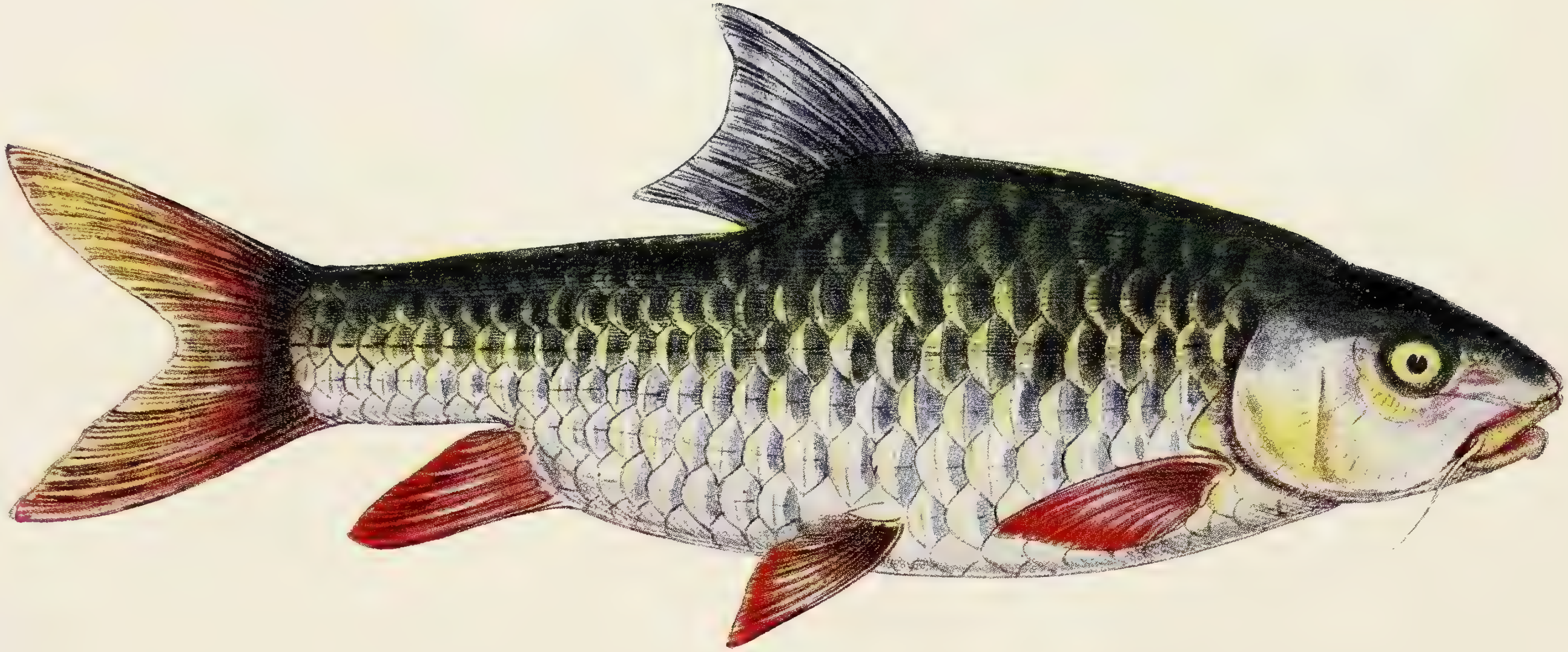
The formula, then reading as follows:—

$$\frac{(L+\frac{1}{4}L) \times (G)^2}{1000} = W.$$

G is the greatest girth.
L is the length from the closed mouth to the fork of the tail.

The formula, as modified, yielded more accurate results—the general tendency was to very slightly under-estimate the true weight. All the fish measured were caught in Lake Fife. The author points out that it is possible that these 'Lake' fish are stockier in build than those taken in running water. It would be interesting if other anglers would apply the formula to river fish and state the results.

The difficulty of weighing heavy fish with the usual portable spring balance which does not register more than a limited number of pounds is one which is frequently experienced by fishermen. Mr. A. Macdonald, writing in the Society's *Journal*, indicates that this difficulty may be overcome by using two or more balances. The balances should be hung from a single cord and the fish suspended so that the strain is borne simultaneously by both scales. Reading the weight indicated by the instruments and adding them together, will give the correct weight.



THE MAHSEER.

Barbus tor (Ham. Buch.)

(Length 5 ft. 6 ins.)

After the line drawing in "Fresh Water Fishes of India," Bevan.

IV

DETAILED DESCRIPTIONS OF SPECIES

THE MAHSEER.

Barbus tor (Ham. Buch.).

Vernacular names: *Khadchi, Masta, Mahsala. Kursi* (Poona) *Kudis* (Satara) are Marathi names given for this fish.

B. iii. D. 12 (3/9). P. 19. V. 9. A. 7-8 (2-3/5). L. l. 25-27. L. tr. 4/4.

Distinctive characters: 4 barbels. 3 spines and 9 rays in the dorsal fin. 2 to 3 spines and 5 rays in the anal. 25-27 scales along the lateral line. The dorsal spine, bony and strong, as long as the head excluding snout. Upper jaw longer, lips lobed. 2½ rows of scales between the lateral line and the ventral fin.

Relative dimensions: Length of head 4-5, height of body 4⅓-5½ in the total length. The diameter of the eye in moderate sized specimens is contained 6¼ to 7½ times in the length of the head.

Colour: Day describes the colour as silvery or greenish along the upper part of the body becoming silvery or shot with gold on the sides and beneath. Lower fins reddish yellow. The colouration varies in different localities and even in the same locality. In lake Fife at Khadakwasla some fish are of a deep golden colour, others light silvery. Again in other waters some fish have a distinct blue tinge, more rarely others are very dark—almost black.

Form: As a general rule Mahseer in lakes, when grown to size, are much stockier in build than those which live in rivers. There is much variation in the shape of the head and thickness of lips. Bevan ascribes the variation to age, type of streams and season of the year. As already indicated, the Mahseer of the Bombay streams and lakes may differ from those of North and South India. They are certainly smaller. The status of the Mahseer is not known. It is possible that there are 6 or 7 different forms or even species inhabiting the waters of the Indian Empire.

Breeding: Thomas in *Rod in India* is of opinion that the Mahseer does not spawn all at one time but repeats the process several times in a season. Mr. C. A. Nevill writing in the Society's Journal (Vol. xxiv, p. 838) states that he has caught female Mahseer with well developed roe during several months of the year. Mahseer were seen by him working themselves over the gravel and small stones in tributary streams and in very shallow waters. He believed that they were scooping out the gravel and stones for the reception of the eggs. With many fishes the eggs ripen gradually, one batch after the other, this succession in the ripening of the ova and eggs is also seen in some of the viviparous fishes.

How many batches of eggs the Mahseer lays in one season is not known. Thomas, from the appearance of the ovaries, believed that there were three.

THE MASUNDI.

Barbus mussullah, Sykes.

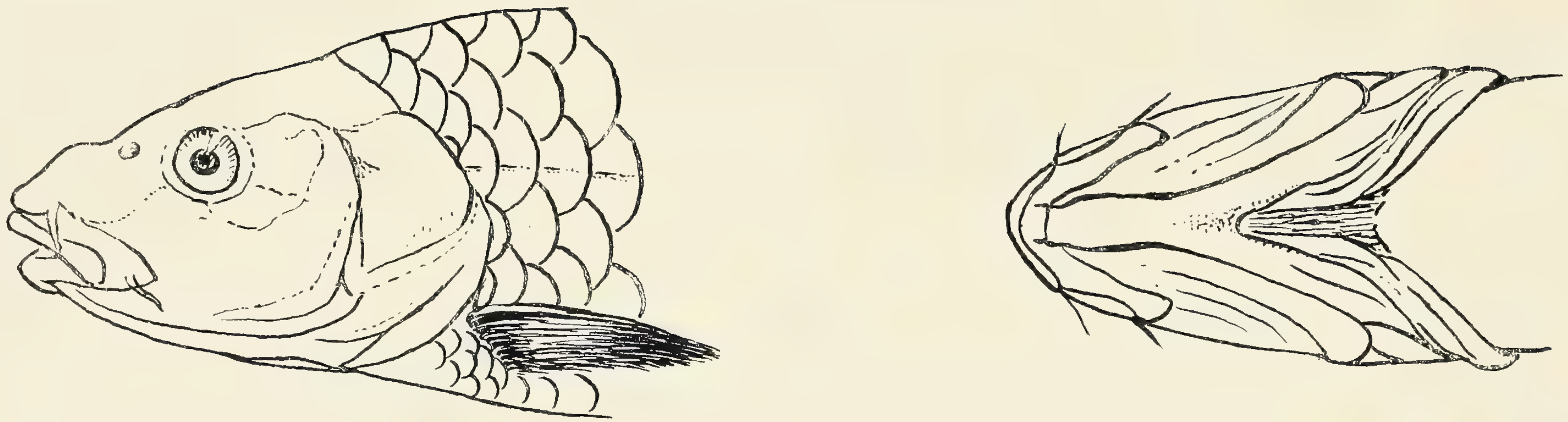
Vernacular name: *Masundi.* (Satara.)

B. iii. D. 13 (3/10). P. 19. V. 9. A. 8 (3/5). L. l. 25-26. L. tr. 4/3.

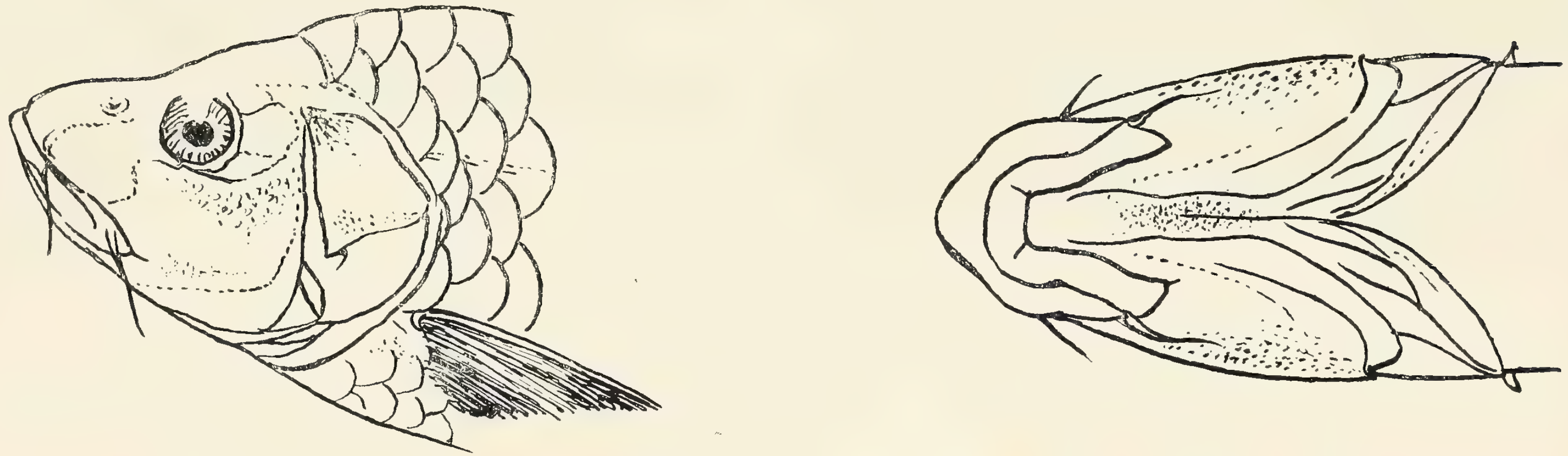
The Masundi may be a form or race of the Mahseer or a distinct species. More examples of this fish are wanted for comparison.

Distinctive characters: 4 barbels. The dorsal fin has 3 spines and 10 rays; the anal 3 spines and 5 rays. There are 25-26 scales along the lateral line; 4 rows between the lateral line and the dorsal fin, 3 rows between this line and the ventral. An important differential character is to be found in the structure of the mouth, the opening of which is much more oblique than in any race of *Barbus tor*. The extremity of the upper jaw lies directly under the middle part of the eye in *B. mussullah*. Sykes, in his description of this fish, mentions a trivial but apparently constant character which will assist further in its identification. This character is the presence under the eye of a group of small tubercles, not confined to one sex and visible with the aid of a lens in quite young fish.

The Masundi is described as common in the Upper Krishna near Satara. It probably occurs in other streams of the Deccan. A specimen weighing 21 lbs. was taken by Mr. MacIver.

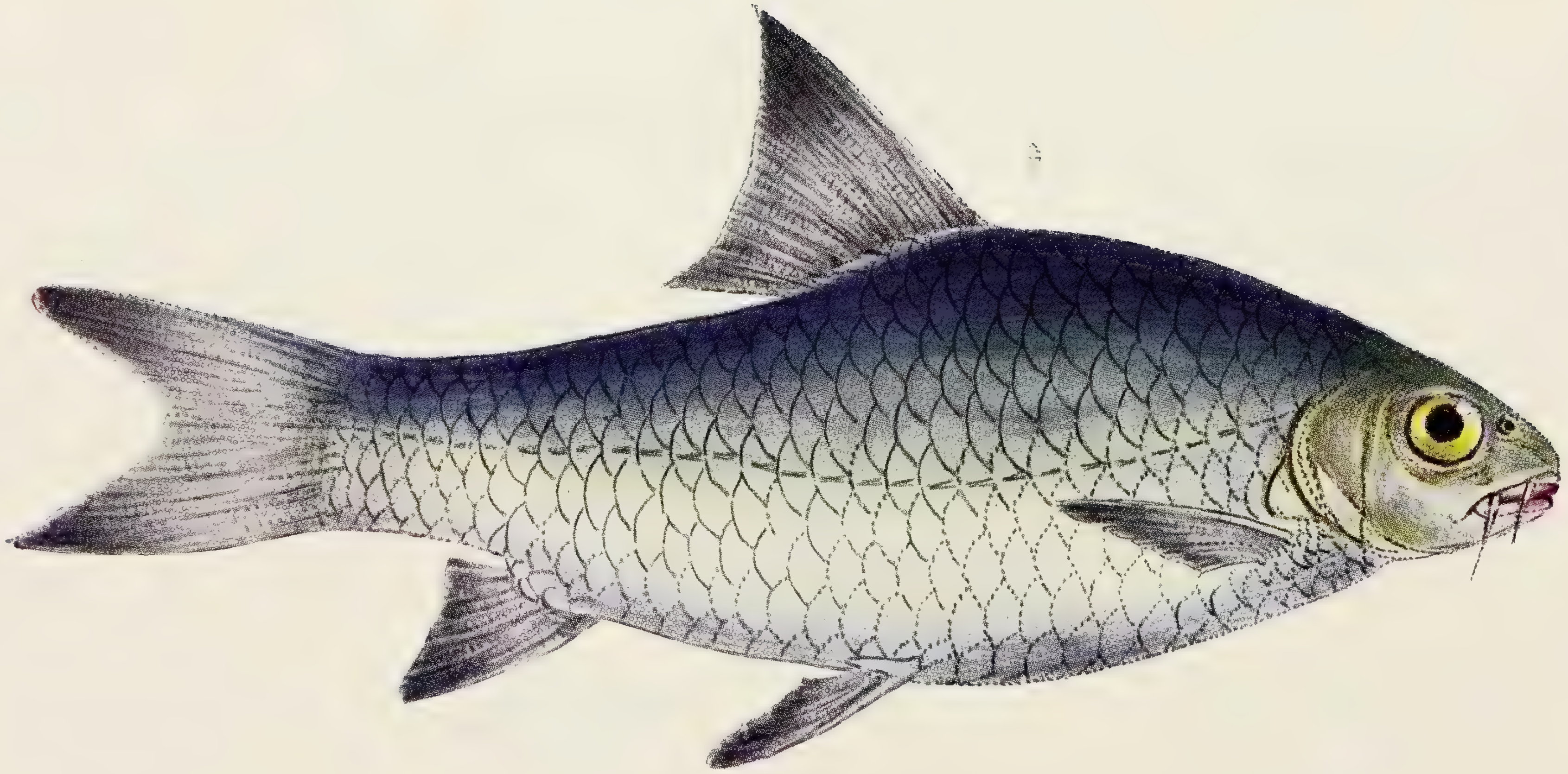


1. Head of a young Mahseer (Barbus tor). *River Kistna. Lateral and ventral view.*



2. Head of a young Masundi (Barbus mussullah). *River Kistna. Lateral and ventral view.*

Annandale, Records of Ind. Museum, Vol. XVI, 1919.



DOBSON'S CARP

Barbus jerdoni dobsoni (Day)

(Length up to 20 ins.)

After the drawing in "Fishes of India," Day.

JERDON'S CARP.

Barbus jerdoni, Day.

Jerdon's Carp is frequently referred to as the 'Carnatic Carp'. The true Carnatic Carp (*Barbus carnaticus*) is not found in the Deccan streams, its range is limited to the rivers of South Kanara, the base of the Nilgiris and the Wynaad.

Dobson's Carp (*Barbus jerdoni dobsoni*) which occurs in the Deccan is very closely allied to Jerdon's. The local name for it round Poona is *Potla*. Day in his 'Fishes of India' indicates that Jerdon's and Dobson's Carp are merely varieties or local races of the same species while MacIver's Carp is described as a race of Jerdon's. We indicate below the distinguishing characters.

Distinctive characters: 4 barbels.

D. 12 (3/9). P. 15. V. 9. A. 8 (3/5). L. l. 27-28. 2½-3½ scales between the lateral line and the ventral	*Barbus jerdoni.*
D. 12-13 (3-4/9). P. 14. V. 9. A. 8 (3/5). L. l. 30-32. 3½ scales between the lateral line and the ventral.	*Barbus dobsoni.*
D. 13 (4/9). A. 3/5. L. l. 31-33. 3½ scales between the lateral line and the ventral.	*Barbus jerdoni maciveri.*

The body in Dobson's Carp is considerably deeper than in Jerdon's, and Dobson's has more scales along the lateral line and more between the lateral line and the ventral fin. These are the only constant differences. All these species can be readily distinguished from the Mahseer by their small mouths.

Colour: Jerdon's Carp is described as silvery. The fins have an orange tint tipped with black. The colouring of Dobson's Carp is bluish above becoming lighter on the sides and beneath; fins edged with gray the upper corner of the dorsal and ends of the caudal blackish. MacIver's Carp is described as brownish above. The caudal dorsal and anal fins are tipped with black—it attains a weight of 20-25 lbs.

THE OLIVE CARP.

Barbus chrysopoma, Cuv. & Val.

Vernacular names: *Kolsi.*

B. iii. D. 12 (4/8). P. 17. V. 9. A. 8 (3/5). C. 19. L. l. 28-30. L. tr. 6/6.

Distinctive characters: 4 barbels. Last undivided, dorsal ray bony and serrated. D. 4/8. A. 3/5. L. l. 28-30. A dark blotch on the sides.

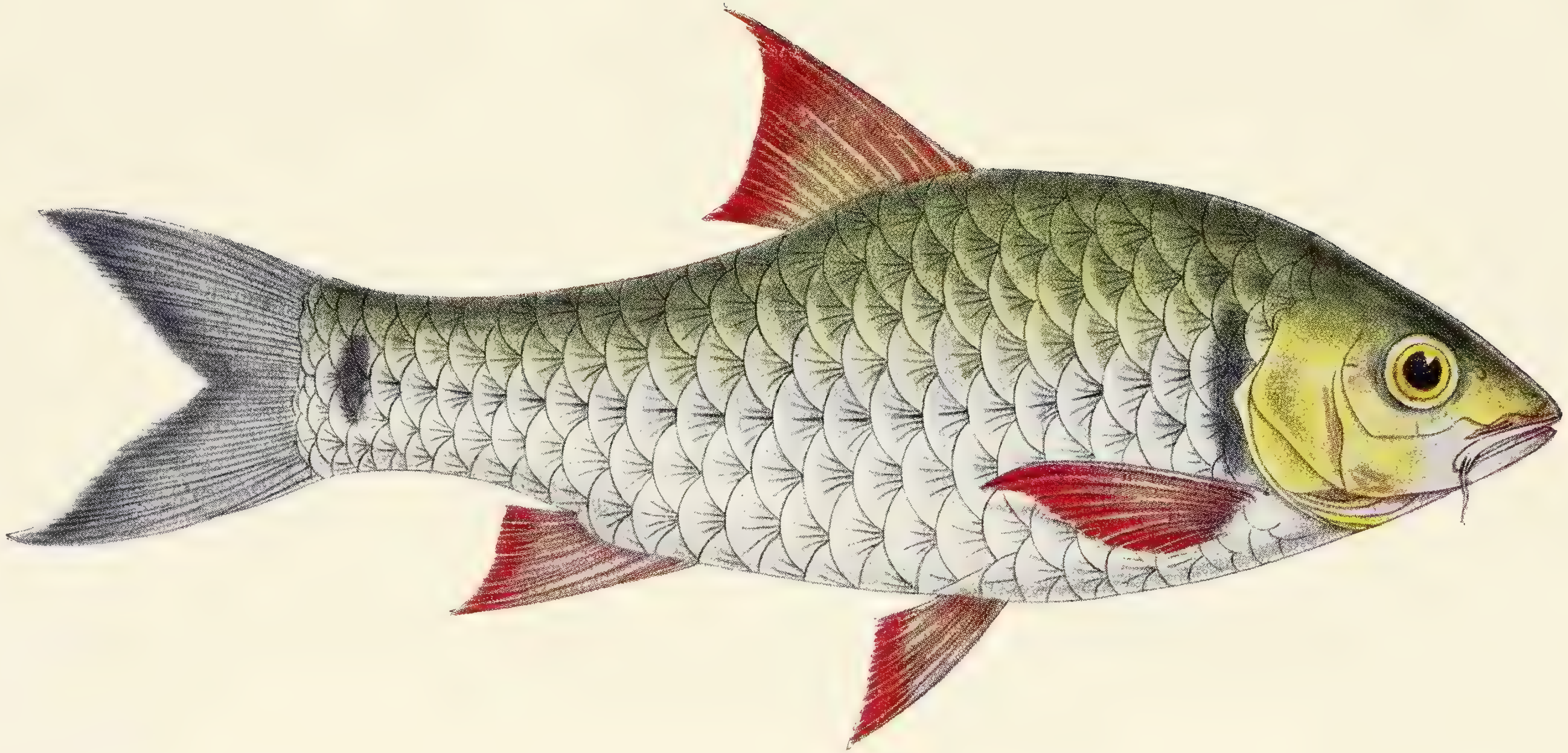
Relative dimensions: Length of head 4⅓-5, height of body 3⅔ times in the total length. The diameter of the eye is contained 3¼-3½ times in the length of the head in a fairly grown specimen.

Colour: Back—greenish with silvery reflections; abdomen silvery. Gill-covers shot with purple and gold. A dark vertical band behind the gill-covers and a dull blotch on the lateral line, just in front of the base of the caudal fin. The spot loses in intensity with age—it is very marked in young specimens whose bodies are bright silvery. Ventral fin, orange, the other fins grey, the dorsal and caudal margined with a darker colour, the anal stained with orange.

Thomas states that the vernacular name *shàni kendæ* or Cow-dung Carp is given to this fish from its colour. But Olive Carp describes it as effectively and sounds better. It attains a length of 2 feet 9 inches and is a very common fish in ponds and tanks and in flooded fields. There are numbers of them in the Powai and Vehar lakes. It adapts itself readily to different conditions and is a suitable fish for introduction into ponds and reservoirs. It is frequently kept in tanks in Hindu temples.

Two other closely related species namely *Barbus sarana* and *Barbus pinnauratus* occur in our area. Day doubted whether *B. pinnauratus* was a true species and suggests that it may be a race of the Olive Carp, while *B. sarana* is possibly a second variety of the same species. The distinctive characters are given as follows:—

D. 3-4/8. A.3/5. L.l. 32-34. *B. sarana.*
D. 3/8. A. 2/5. L. 1. 29-30. *B. pinnauratus*

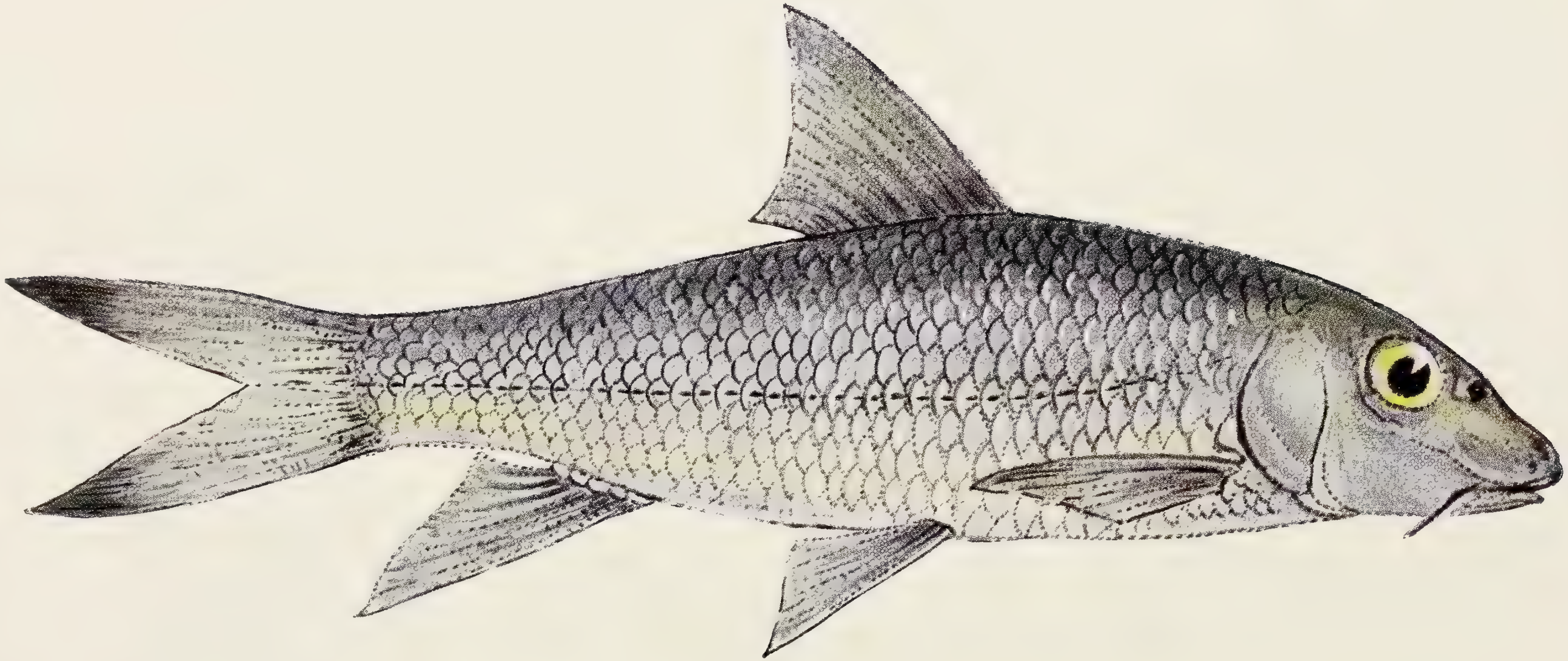


The Olive Carp

Barbus chrysopoma, Cuv. & Val.

(Length up to 2 ft. 9 ins.)

After the drawing in "Rod in India," Thomas. 2nd Edn.



BUCHANAN'S CARP

Barbus curmuca (Buchanan)

(Length up to 4 ft.)

After the drawing in "Fishes of India," Day.

BUCHANAN'S CARP.

Barbus curmuca (Buchanan).

B. iii. D. 12 (3/9) P. 16. V. 9. A. 8 (3/5). C. 18. L. l. 41. L. tr. 8/7.

Distinctive characters: D. 3/9., A. 3/5., L. l. 41. 3½ scales between the lateral line and the ventral.

Belongs to the 4 barbelled group—the last undivided ray of the dorsal fin is articulated and weak. The snout is conical, the head compressed with a depression between the eyes. The line of the back is more convex than the abdomen; the caudal fin is deeply forked, its lobe pointed.

Colour: Silvery. Lightest on the sides and beneath, tips of caudals blackish. In the young the middle of the third of the caudal is orange-tipped with black.

Day gives the habitat of this fish as the Western Ghats of India and says that it reaches 4 feet in length.

The Malabar Carp (*Barbus malabaricus*, Jerdon), which Day limits to South Kanara and Malabar, has been obtained in the Krishna at Satara. It may occur in the streams further north. It belongs to the same group of Barbus as *B. curmuca*, having 4 barbels and the last undivided dorsal ray articulated and weak. The distinctive characters are indicated as follows:—

D. 3-4/9. A. 3/5. L. l. 24. 1½ scales between the lateral line and the ventral.

THE KUDALI (*Barbus parrah*, Day).

THE KOOLIS (*Barbus kolus*, Sykes).

Barbus parrah: B. iii. D. 11 (3/8). P. 15. V. 9. A. 8 (3/5). C. 19. L. l. 25-26. L. tr. 5/5.

Barbus kolus: B. iii. D. 12-13 (3-4/9). P. 15. V. 9. A. 8 (3/5). C. 19. L. l. 40-43. L. tr. 10/8.

Both these fish belong to the 2 barbelled group. They are common fish round Poona and in the Deccan generally. *B. parrah* reaches 6 in. in length and *B. kolus* grows to slightly over a foot.

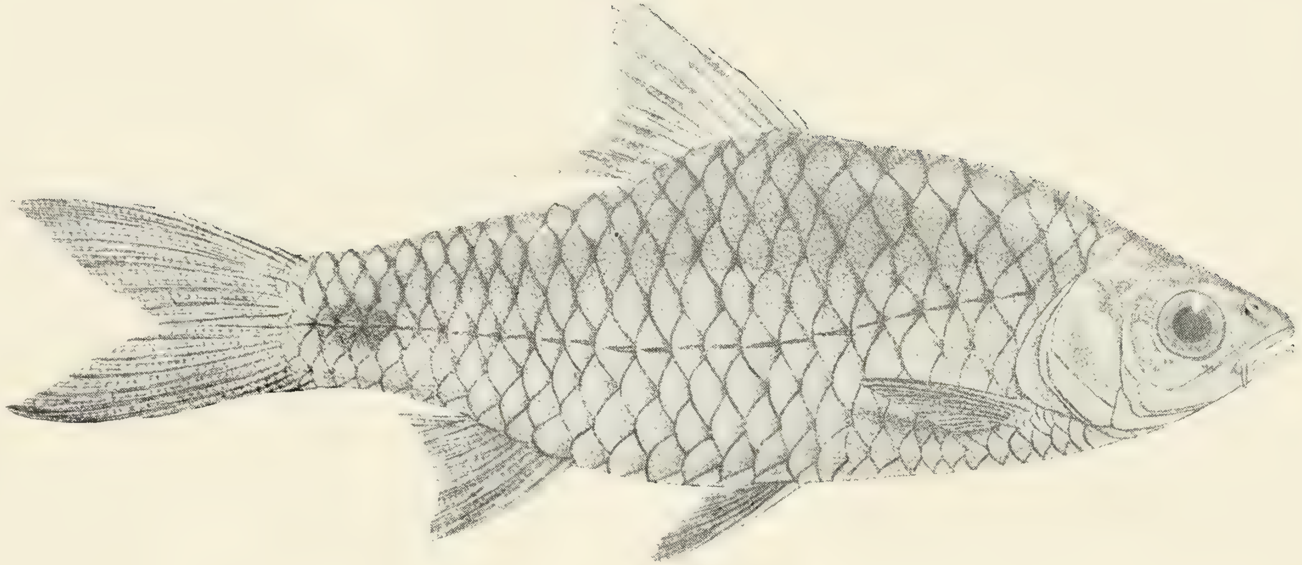
Distinctive characters:

Last undivided dorsal ray strong, bony not serrated.
D. 3/8. A. 3/5. L. l. 25-26.
3½ scales between the lateral line and the ventral.
A dark blotch on the lateral line from the 20th
to 22nd scale ... ... *Barbus parrah.*

Last undivided dorsal ray soft and flexible.
D. 3-4/9. A. 3/5. L. 1. 40-43.
4-5 scales between the lateral line and the
ventral ... ... *Barbus kolus.*

Colours: In *Barbus parrah* the back is greenish and divided from the silvery abdomen by a dark bluish line. Cheeks golden red: Pectoral, ventral and anal tinged with yellow; dorsal and caudal dusky. There is a diffused black spot on the lateral line extending from the 20th. to the 22nd. scale. Eyes golden.

The colouring of *B. kolus* is silvery with a yellow tinge. The dorsal, caudal, and anal fins are tipped with grey.

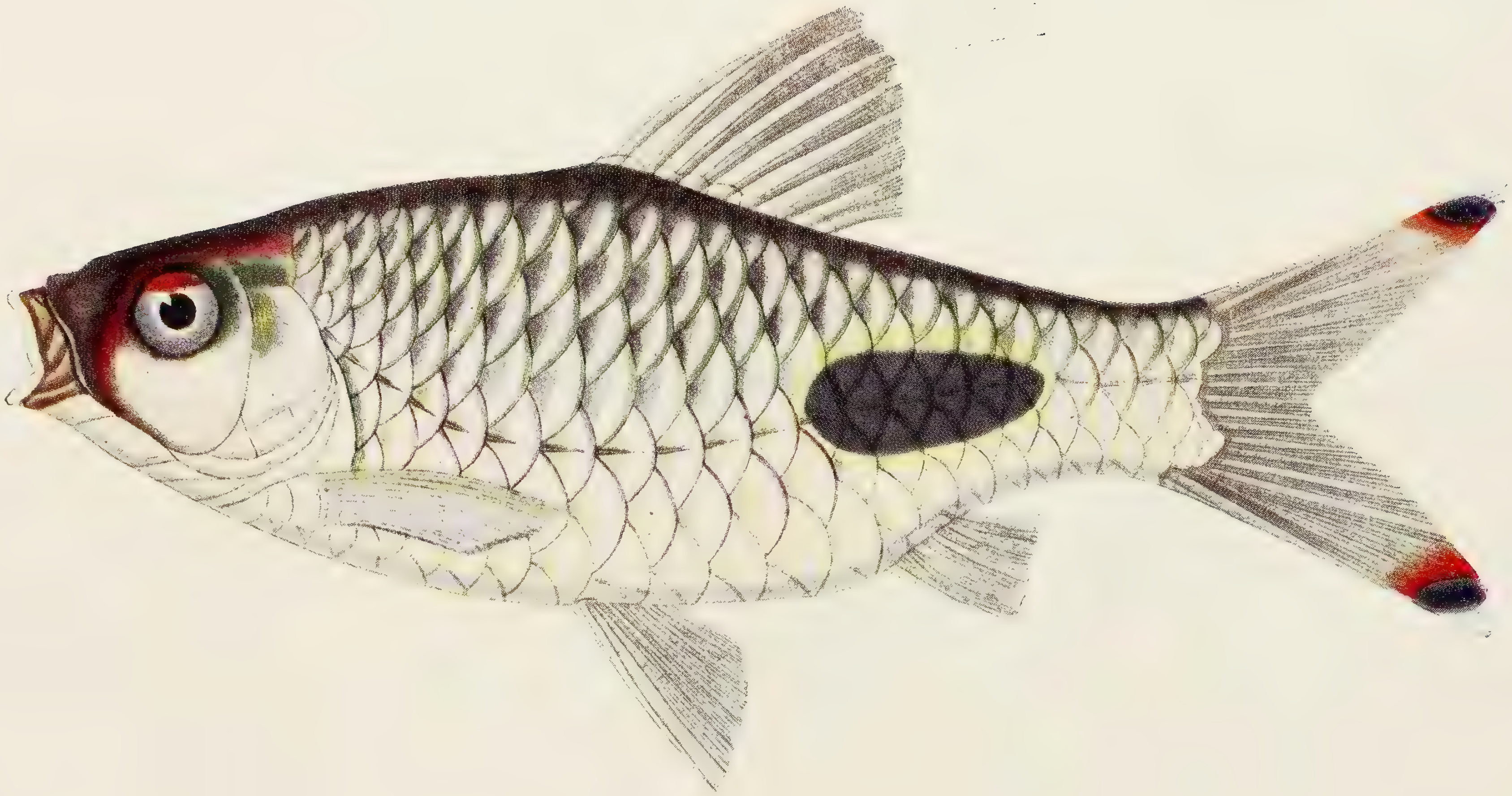


THE KUDALI

Barbus parrah (Day)

(Length up to 6 ins.)

"*Fishes of India*," *Day*.



THE BLACK—SPOT

Barbus filamentosus (Cuv. & Val.)

(Length up to 6 ins.)

Reproduced from the "Rod in India," Thomas. 2nd Edn.

THE BLACK SPOT.

Barbus filamentosus, (Cuv. & Val.).

B. iii. D. 11 (3/8). P. 15. V. 9. A. 7. (2/5). C. 19. L.1. 21. L.tr. 4/4.

The Black Spot is grouped among those fishes of the genus *Barbus* which have no barbels. They form a group of small fishes common all over India in ponds.

Distinctive characters: D. 3/8. L.l. 21. No barbels, last undivided dorsal ray soft and flexible. Branched dorsal rays extended as long filaments, hence the Latin name. A black mark near the posterior end of the lateral line on the 14th and 15th scales. Dark marks on each lobe of the tail fin which is red with black tip. Dorsal and ventral fins almost black. The general colour is silvery, each scale with a metallic green edging. Immediately after death the whole body becomes scarlet.

Thomas states that Black-spot breed well in ponds and tanks, grow to 6 inches in length and are deep and thick for their size. They take a small fly with a gentle suck like a dace. They congregate in shoals and require careful fishing. They may also be taken on worms, paste, gram or a miniature spoon. Black-spot are said to run about 6 to the pound, though individuals scaling quite ¾ lb. may be taken. It is essentially a fish of tanks and still water. Breeds in December and the young are common in January. It is much valued as food.

Two other fish belonging to the same group of the genus are found in our area. *Barbus ambassis* (Day), called *bhondgi* in the Poona District and *Barbus ticto* (Ham. Buch.). In both species the last undivided dorsal ray is bony and serrated. *Barbus ambassis* has 36 scales along the lateral line. *B. ticto* has 23. The former grows to 6 ins. and the latter is rarely over 3 ins.

The Rohu or Rohi.

Labeo rohita.

Vernacular name: *Tambada Massa.*

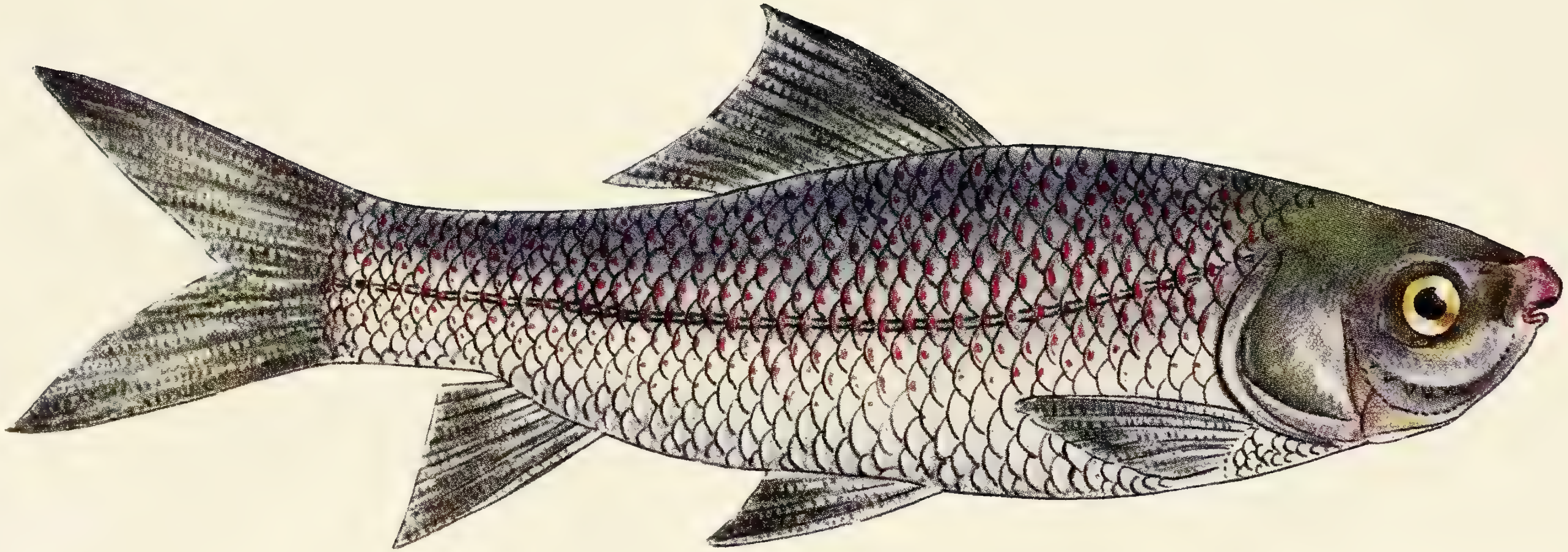
B. iii. D. 15-16 (3/12-13). P. 17. V. 9. A. 7. (2/5). C. 19. L. l. 40-42. L. tr. 6½-9.

Like the Barbels, the Labeos are members of the Carp Family. They can be recognized from the fishes of the genus *Barbus* by their more elongate bodies. The structure and position of the mouth is also distinctive. It opens downwards not forwards and is situated under the projecting snout. The lips are thick and fleshy, one or both lips having an inner transverse fold which is covered with a horny substance. Eight species occur in our area. The best known is perhaps the Rohu *(L. rohita)*—though the name *Rohu* is indiscriminately applied to other members of the genus.

Distinctive characters: D. 15-16. L. l. 40-42. L. tr. 6½/9.
4 barbels. Lips fringed.

Colour: Bluish or brownish along the back becoming silvery along the sides and beneath. Sometimes there is a red mark on each scale. The fins are reddish, in some specimens black.

The Rohu grows to 3 feet or more in length. It is deep in body and narrows suddenly towards the tail. It is much esteemed as food and adapts itself readily to the still waters of a lake or tank.

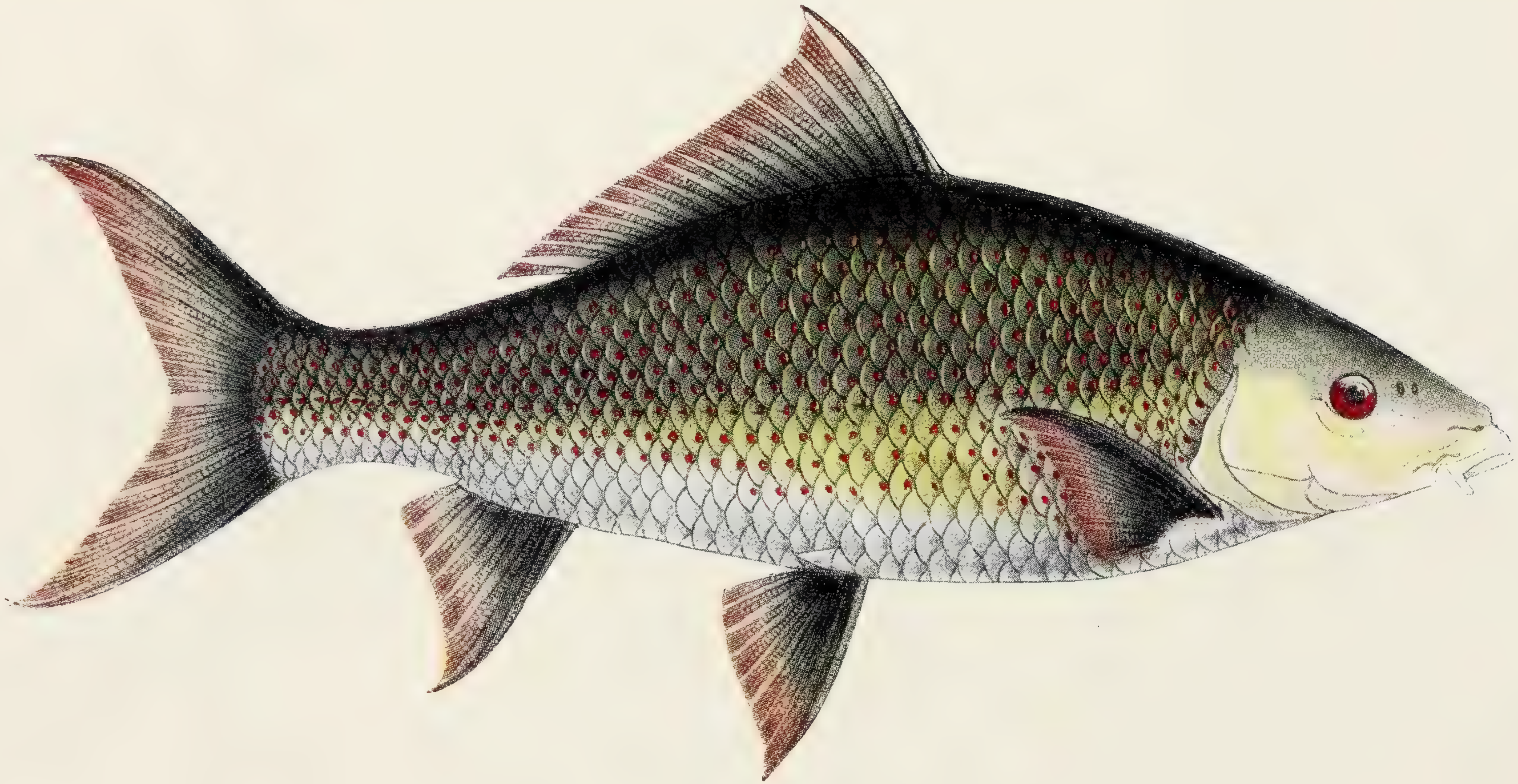


THE ROHU

Labeo rohita (Ham. Buch.)

(Length up to 3 ft. or more.)

After the drawing in "Fishes of India," Day.



THE KANOSHI

Labeo calbasu (Ham. Buch.)

(Length up to 3 ft.)

Reproduced from the "Rod in India," Thomas. 2nd Edn.

The Kanoshi.

Labeo calbasu (Ham. Buch.).

Vernacular names : *Kanoshi*, Marathi; *Dai*, Cutch.

B. iii. D. 16-18. (3/13-15). P. 19. V. 9. A. 7. (2/5). C. 19. L. l. 40-44. L. tr. 7½/8.

Distinctive characters: D. 16-18. L. l. 40-44. L. tr. 7½/8. 4 barbels. Slate colour.

Differs from the Rohu in having a larger number of rays in the dorsal fin. There are 3 spines and from 13-15 rays. In some districts the adults have very elongated fins; the first few dorsal rays reaching even to the base of the tail fins, the ventral touching the base of the anal while the anal fin when laid flat, reaches the middle of the caudal.

Colour: Blackish; sometimes many of the scales, especially of those living in clear streams have a red centre. Fins black, occasionally the end of the upper lobe of the caudal is white.

L. calbasu grows to 4 feet in length.

Six other species of *Labeo* occur in our area. They may be recognised as follows:—

D. 19-22. L. l. 44-47. L. tr. 9-10/8-9. 4 barbels	*Labeo fimbriatus.* (Tamka or Tambra)
D. 15-16. L. l. 39. L. tr. 7/8. 4 barbels	*L. porcellus.*
D. 14. L. l. 39-40. L. tr. 8/7. 2 maxillary barbels	*L. potail.*
D. 11/12. L. l. 37-39. L. tr. 7-7. 2 small maxillary barbels. Silvery ...	*L. boga* (Sande).
D. 11. L. l. 38. L. tr. 8/9, one pair of maxillary barbels; a deep groove across snout	*L. nukta* (Nakta and Nakta Shendwa).
D. 11. L. l. 38. L. tr. 6/6. 2 barbels.	*L. kawrus.*

DANDVAN.

Rasbora daniconius (Ham. Buch.).

Vernacular name: *Dandvan* (Marathi).

B. iii. D. 9 (2/7). P. 15. V. 9. A. 7 (2/5). C. 19. L. l. 31-34. L. tr. 4½/5. Vert. 18/14.

A small fish rarely exceeding 8 inches in length. The belly is rounded. False gills or pseudo-branchiæ are present. They appear as thin, superposed plates on the inside of the gill-cover opposite the true gills and can be seen by turning back the gill-cover. The cleft of the mouth is oblique, the lower jaw protrudes slightly, it bears one central and two lateral prominences which fit into corresponding indentations in the upper jaw. The dorsal fin has no bony rays and a few branched ones. It arises behind the origin of the ventral but does not extend above the anal.

Two species occur in our area.

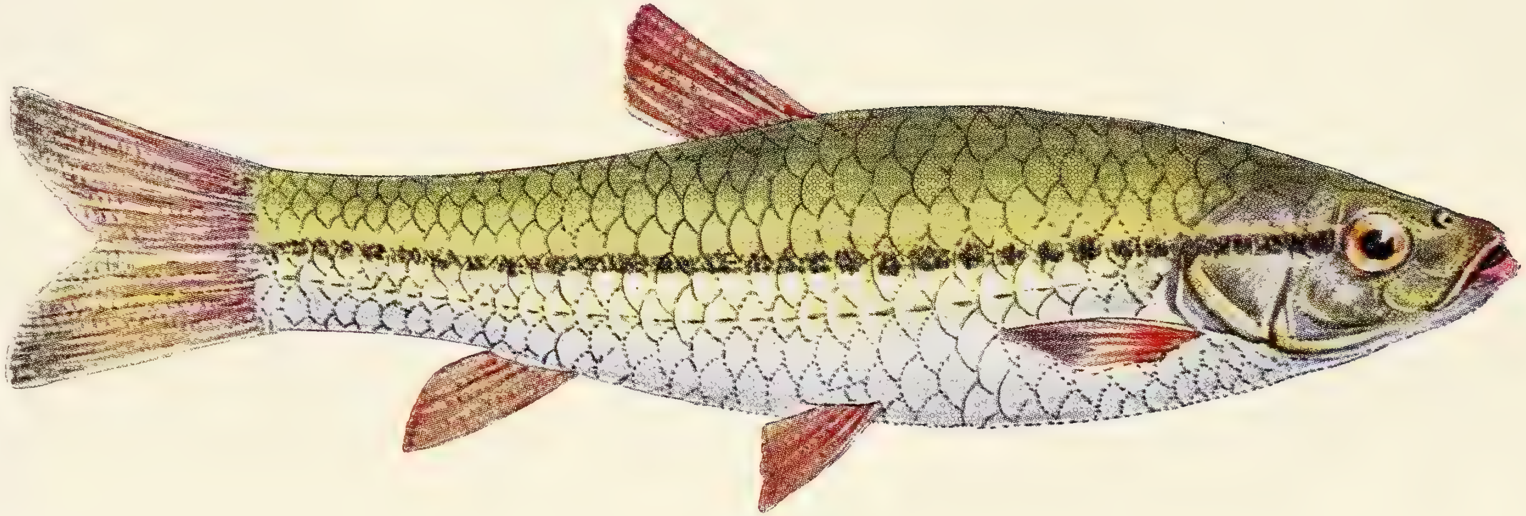
Distinctive characters: No barbels.

D. 2/7. A. 2-3/5. L. l. 31-34. generally a black lateral stripe	*R. daniconius.*
D. 2/7. A. 2/5-6. L. l. 26-29. caudal fin edged with black	*R. rasbora* (*buchanani*).

Colouration: *R. daniconius*—A black band more or less distinct passes from the eye to the base of the caudal fin. Sometimes the band is obliterated in the forepart of the body and is seen only as a spot at the side of the base of the tail.

R. rasbora—Silvery with a faint streak along the sides.

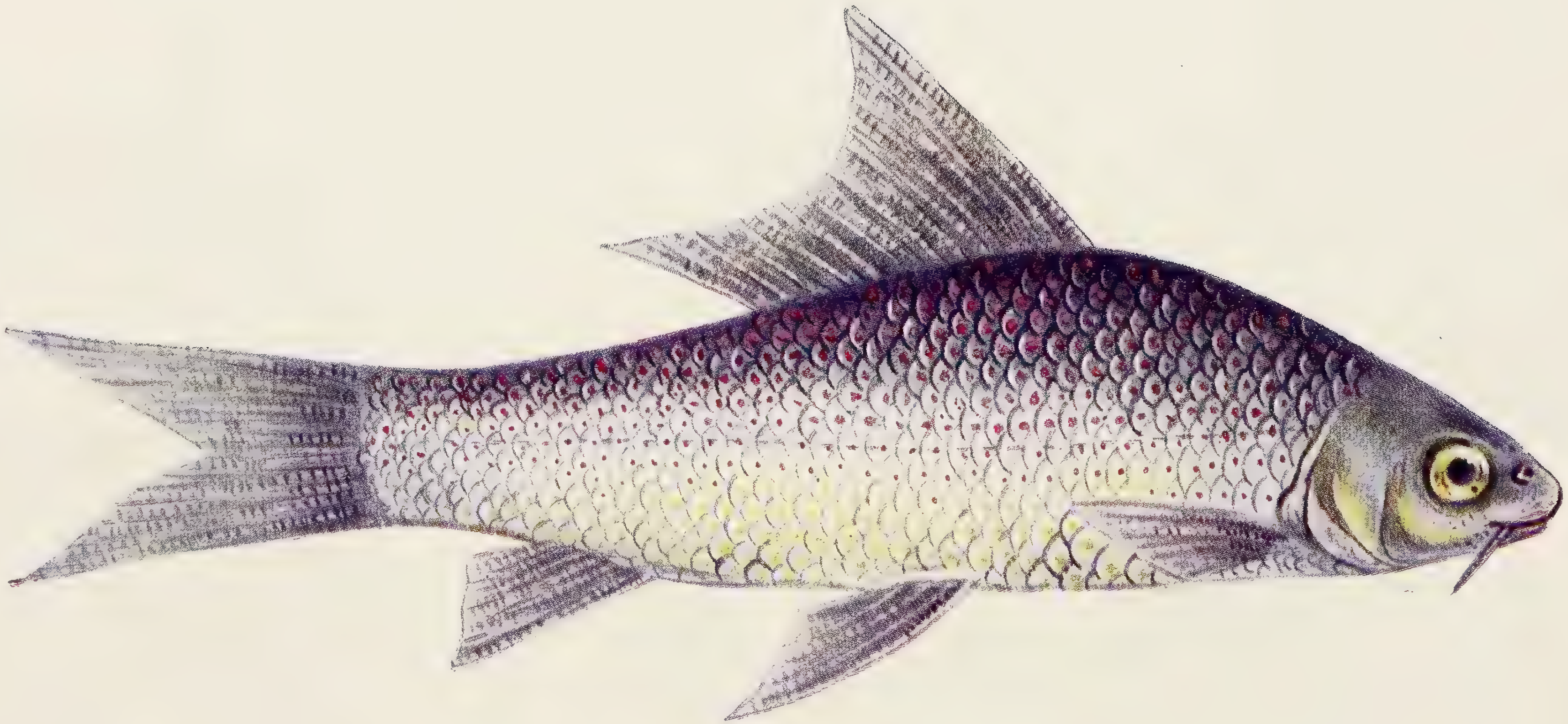
R. daniconius is a very common fish, more common than *R. rasbora*. It rises readily to fly. Two midge flies on a very fine gut is just the right outfit. They may be also taken on a single grain of gram fished like a fly. They are readily adaptable to tanks and reservoirs and are the natural food of the larger predatory fishes. They invade the shallowest water in search of food and are useful in keeping down mosquito larvæ.



Rasbora daniconius (Ham. Buch.)

(Length up to 8 ins.)

After the drawing in "Fishes of India," Day.



THE WHITE CARP.

Cirrhina cirrhosa (Bloch)

(Length up to 2½ ft.)

After the drawing in "Fishes of India," Day.

The White Carp.

Cirrhina cirrhosa (Bloch).

B. iii. D. 17-19 (3-4/14-15). P. 19. V. 9. A. 8 (3/5). C.19. L. l. 42-44. L. tr. 8/9. Vert. 21/17.

The genus *Cirrhina* includes some fine fish, elegant in form and brilliantly coloured in gold, bronze or silver. The body is elongate, the snout depressed and bluntly rounded. The mouth is broad, the lips thin and clean. There is a small knob in the centre of the lower jaw at the point where the two jaw bones meet. 4 species occur in our area. The present species is recognised as follows:—

Distinctive characters:

D. 17-19. L. l. 42-44. 4 barbels; upper lips without fringes.

The dorsal fin has 3-4 spines and 14 or 15 rays none of which are bony. It is as high as the depth of the body and arises considerably in advance of the ventrals. Its upper margin is concave. The ventral fin has 9 rays, the anal 3 spines and 5 rays and the caudal 19 rays. It is deeply forked. There are 42-44 scales along the lateral line and 8 rows above and 9 rows below it.

Colour: Silvery. Every scale with a red centre except along the belly where the scales are dull or yellowish white. Dorsal and caudal stained with grey, also the outer end of the pectoral.

Day gives the length as 1½ feet. Thomas states that it may grow to 2½ feet. A bottom-feeding fish to be caught on paste. Very active and good for the table.

Hamilton's Carp.

Cirrhina mrigala (Ham. Buch.).

B. iii. D. 15-16 (3/12-13). P. 15. V. 9. A. 8 (3/5). C. 15. L. l. 40-45. L. tr. 6½-7/8½.

Distinctive characters: D. 15-16. L. l. 40-45. Two barbels. Upper lip entire.

Differs from the White Carp in having 2 instead of 4 barbels. The length of the head is contained 5-5¼ times and the height of the body 4-5½ times in the total length. The eyes are situated in the anterior half of the head. The diameter of the eye is contained 3½-4 times in the length of the head.

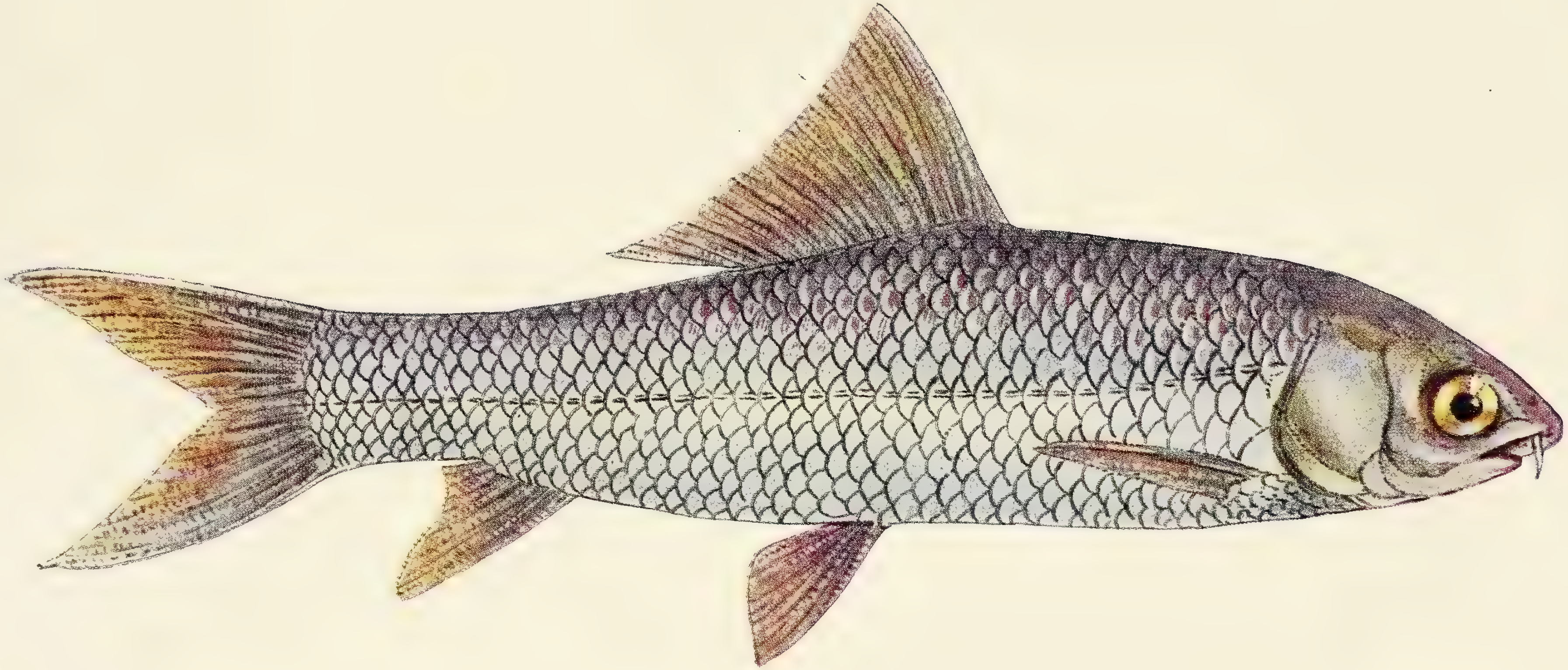
Colour: Silvery; dark grey along the back, sometimes with a coppery tinge. Pectoral, ventral and anal orange stained with black.

This is an excellent species for stocking tanks. It grows to 3 feet in length. Day mentions an 18-pounder taken from a tank in Rangoon. It takes any bait but is believed to prefer worms.

Two other species are found in the Deccan streams. The distinctive characters are as follows:—

D. 10-11. L. l. 35-38. One pair of short barbels in front of the snout. These are sometimes absent. Upper lip with or without a slight fringe ... ... *C. reba.*

D. 10. L. l. 48. 2 very short barbels ... *C. fulungee.*

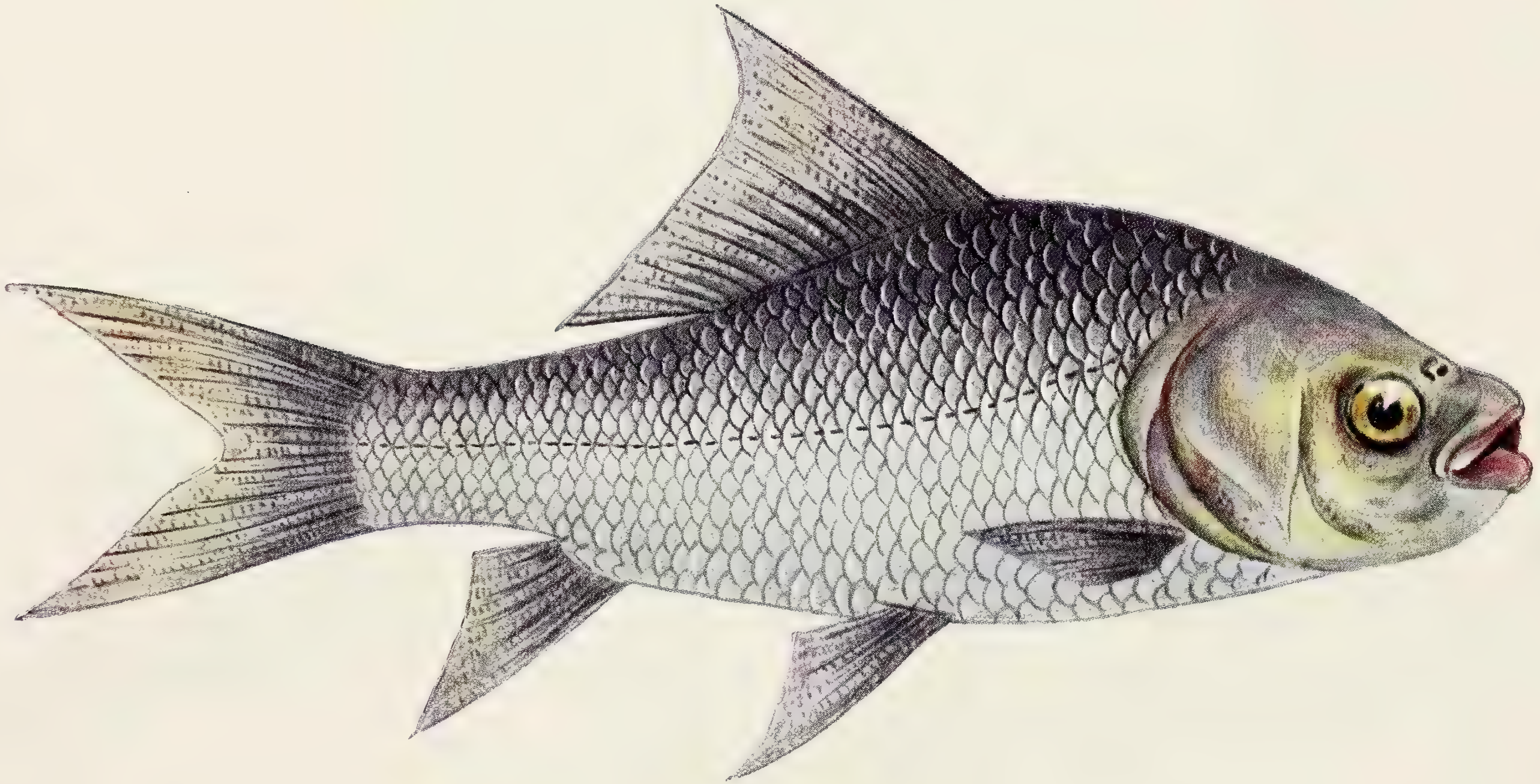


HAMILTON'S CARP.

Cirrhina mrigala (Ham. Buch.)

(Length up to 3 ft.)

After the drawing in "Fishes of India," Day.



THE CATLA.

Catla buchanani (Cuv. & Val.)

(Length up to 4 ft.)

After the drawing in "Fishes of India," Day.

The Catla

Catla buchanani (Cuv. & Val.).

B. iii. D. 17-19 (3-4/14-16). P. 21. V. 9. A. 8 (3/5). C. 19. L. l. 40-43. L. tr. 7½/9. Vert. 17/18.

Distinctive characters: The Catla is distinguished from other genera of Carps by its broad head and its wide mouth with prominent lower jaw. The upper jaw has no lip; the lower is moderately thick having a continuous free posterior margin. There is a moveable articulation at the juncture of the jaw bones. The gill-rakers, horny processes on the inside of the bony supports to the gills, are long, fine and closely set.

Length of head 4¼ to 4¾; height of body 3 to 3½ in the total length. Diameter of eyes 6-7 in the total length of the head, 2 diameters from the end of the snout, and 3 apart.

Scales. 40-43 along the lateral line. 5½-6½ rows between it and the ventral fin.

Colour. Greyish above, becoming silvery on the sides and beneath. Fins dark coloured, in some specimens nearly black.

The Catla attains a length of 4 feet and scales up to 80 lbs. in weight. It is a bulky fish.

Cat-Fishes : Siluridæ.

The Wallago

Wallago attu (Day).

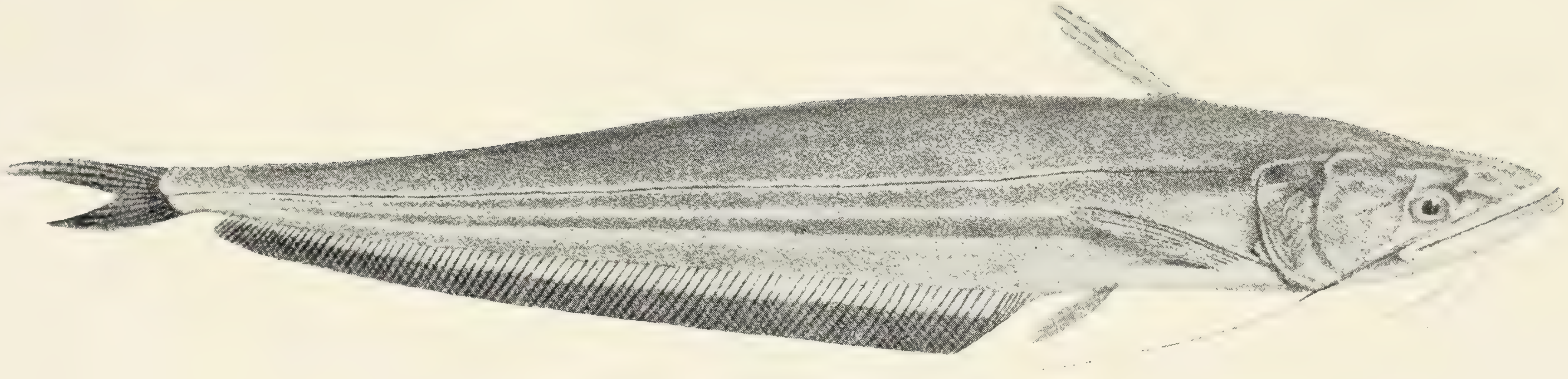
Vernacular names : Shirada, Shura, Padi.

B. xix-xxi. D. 5. P. 1/13-15. V. 8-10. A. 86-93 (4/82-89). C. 17. Vert. 13-56.

The Wallago, frequently described as the Fresh Water Shark, is essentially a tank fish. A straight-backed fish, long-bodied and narrow; long in the snout with a slightly projecting lower jaw. The cleft of the mouth is deep, extending below or even behind the eyes. 4 barbels; 2 long ones on the upper and 2 small ones on the lower jaw. A short spineless dorsal fin arising exactly above, or slightly in advance, of the ventral. The anal is long and ends near the caudal; the ventrals with 8-10 rays.

Distinctive Characters: Adipose fin; one very short spineless dorsal situated above or very slightly before the ventral, 4 barbels, one maxillary and one mandibular pair. Nostrils remote from each other. Eye above the level of the angle of the mouth; not covered with skin. Head and body covered with soft skin, anal fin long, terminating near the caudal. Caudal fin consisting of two rounded lobes.

Thrives well in tanks, is good eating but is voracious and destroys a large number of fish; grows up to 6 feet in length. Bait with small fish or a small 1½ inch spoon; will also take dead bait.

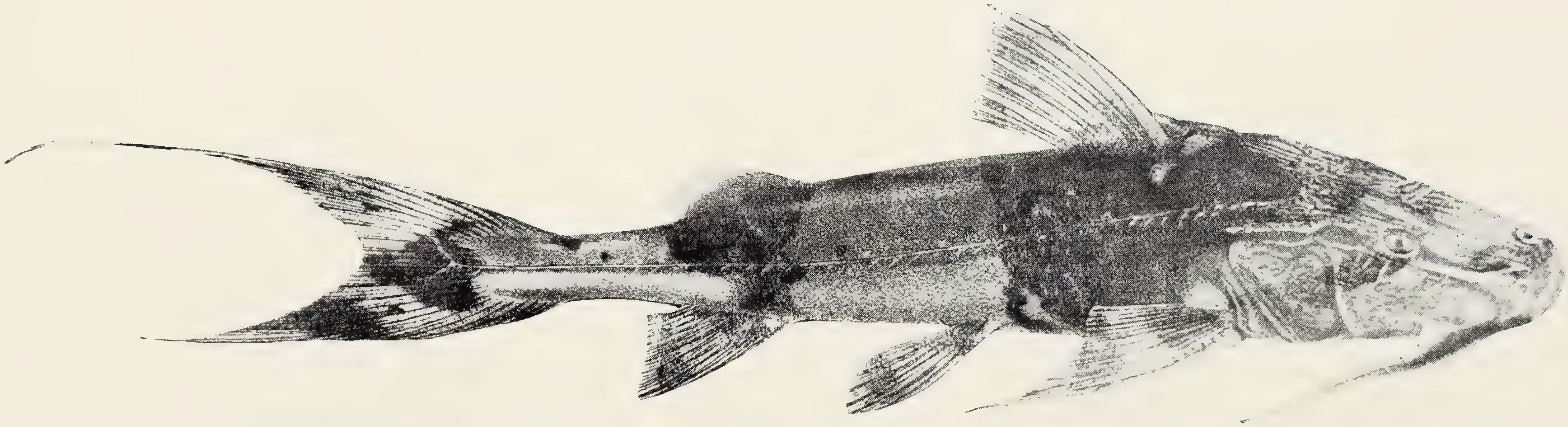


THE WALLAGO OR " FRESH WATER SHARK."

Wallago attu (Bl. Schn.)

(Length up to 6 ft.)

" *Fishes of India,*" *Day.*



THE GOONCH

Bagarius yarrellii (Ham. Buch.)

(Length up to 6 ft.)

"Fishes of India," Day.

THE GOONCH

Bagarius yarrellii (Ham. Buch.).

Vernacular names: *Mutauda, Tharota.*

B. xii. D. 1/6-0. P. 1/12. V. 6. A. 13-15 (3/10-12). C. 17.

Like *Wallago attu*, a bulky fish growing up to 6 feet in length but it is essentially a river fish. The head is flat, the mouth set forward, the upper jaw projecting over the lower. 8 barbels, a nasal pair, a pair on the upper jaws, 2 pairs on the lower jaws which are armed with pointed unequal teeth. The first dorsal fin arises in advance of the ventrals. It has one spine and 6 rays, the ventral with 6 rays, the anal is of moderate length, the caudal deeply forked, its upper lobe prolonged.

Distinctive Characters: Second soft dorsal fin present. First dorsal with one spine and 6 rays, anal fin short; 8 barbels. The anterior and posterior nostrils remote from each other, the posterior provided with a barbel. Teeth on the palate in a continuous band. Eyes with free orbital margins. Caudal deeply forked. Ventrals six, rayed.

Colour: Body grey or yellowish with large irregular brown or black markings and cross bands. A black base to all the fins and generally a dark band across each.

Takes live bait well but is difficult to kill, sluggish, goes to the bottom and generally escapes.

MURRAL

OPHIOCEPHALIDÆ.

Ophiocephalus.

The *Ophiocephalidæ* or Snake-heads, so called because of the plate-like scales covering the cranium, are commonly known as Murral. They are equally common in rivers and tanks. Rather pike-like in appearance these fish have bony bodies, flattened heads and large mouths, the jaws and palate well armed with teeth. The dorsal and anal fins are long and spineless. The species which live in tanks keep much to the shallow and grassy edges.

Seven species are recorded from our area. Their *distinctive characters* are as follows:

O. marulius (Ham. Buch.) D. 45-55. A. 28-36. L. l. 60-70. L. tr. 4½-6½/13-11 or 5½-8½/13-11. Scales on head moderate. 15-16 rows between dorsal fin and snout. Ventral more than half length of pectoral. Height of body 1/7 of total length. A black, white-edged eye spot on the caudal fin.

O. leucopunctatus (Sykes). *Maral* (Marathi). D. 47-53. A. 28-35. L. l. 59-60. L. tr. 4½-6½/13-11 or 5-8/13-11. Scales as in *O. marulius*. Ventral ⅔ as long as the pectoral. No ocelus on the caudal fin.

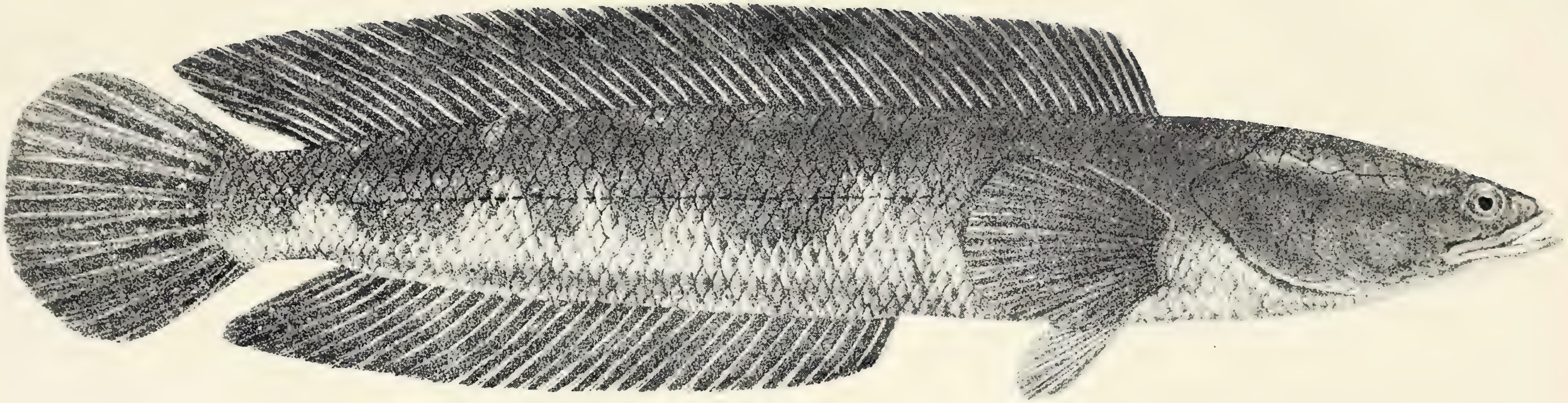
O. pseudomarulius, Gunth. D. 52. P. 17. V. 6. A. 35. C. 15. L. l. 64. L. tr. 6-7/14-10. 10 rows of scales between base of snout and dorsal fin. Height of body 4⅔ the length measured from the snout to the base of the caudal fin. Ventral fin ¾ of the pectoral.

O. micropeltis, Cuv. & Val. D. 43-46. A. 27-30. L. l. 95-110. L. tr. 7-8/13-12. Vert. 53. Scales on head small; 22 between dorsal fin and snout; 16 or 17 between orbit and angle or preopercle.

O. striatus, Bloch. *Dakhu* (Marathi). D. 37-45. A. 23-26. L. l. 50-57. L. tr. 4½-7/9-7 or 5½-8/10-9. Scales on head large. 18-20 rows between snout and origin of dorsal fin; 9 between orbit and angle of opercle.

O. gachua, Ham. Buch. D. 32-37. P. 15. A. 21-23. C. 12. L. l. 40-45. L. tr. 3-4/7-6. Scales on head large; 4 or 5 between orbit and angle or opercle; 12 or 13 between origin of dorsal fin and snout. Ventral ⅔ length of pectoral.

O. punctatus, Bloch. D. 29-32. P. 17. A. 21-23. C. 12. L. l. 37-40. L. tr. 4-5/9/9/6. Head scales as in *O. gachua*. Ventral ¾ length of pectoral.

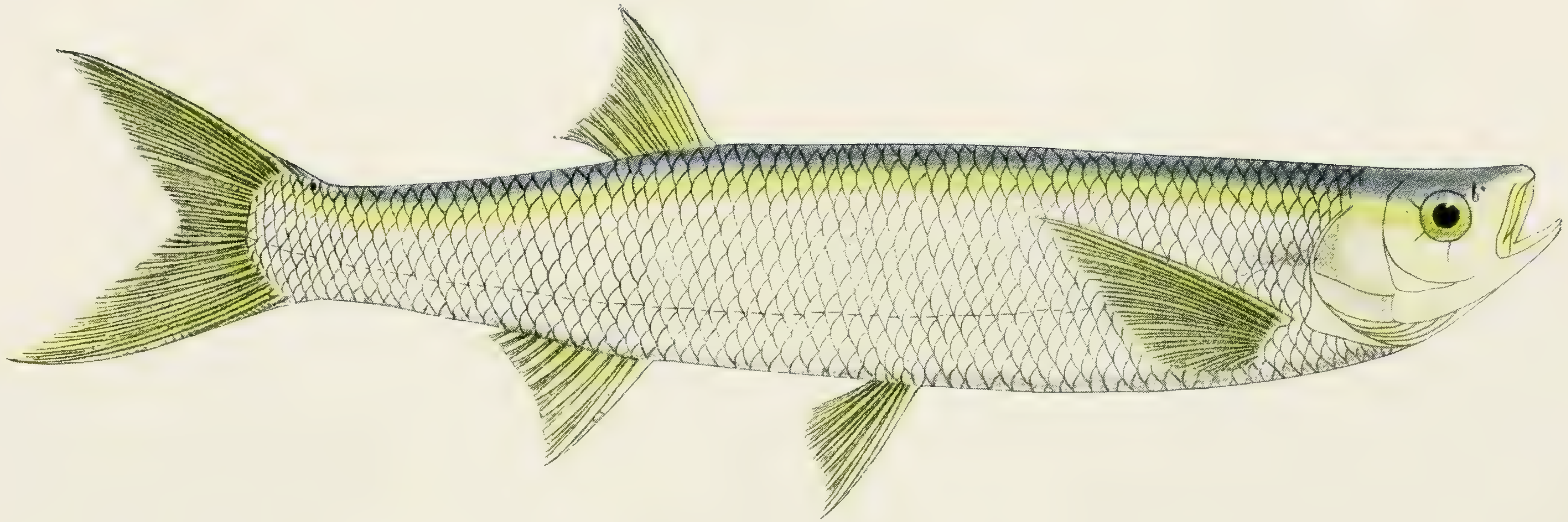


THE BANDED MURRAL.

Ophiocephalus striatus (Bloch)

(Length 3 ft. or more)

"*Fishes of India,*" *Day.*



THE CHILWA

Chela argentea (Day)

(Length up to 9 ins.)

Reproduced from the "Rod in India," Thomas. 2nd Edn.

V

Fishes Suitable for Introduction in Local Waters.

The Chilwa.

Chela argentea, Day.

The Chilwas are bright silvery fishes with elongate compressed bodies. The abdominal surface narrows to a fine edge. The mouth is turned upwards and the lower jaw prominent. There is a small nob at the juncture of the jaw bones. The dorsal fin is short, has no bony rays and is set far back almost opposite the anal.

Distinctive characters:

D. 9-10, A. 17-19, L. l. 43-45. L. tr. 6½-7/3.

The lower jaw does not project. The dorsal fin is situated over the commencement of the anal. The pectoral fin reaches the ventral. The lateral line descends gradually from the first 12 scales, finally attaining the centre of the caudal.

Colour: Silvery with a lateral band which fades after death. Caudal and anal fins with dark edges.

Chela argentea is a fish of the rivers of eastern and south India. It should be introduced to all waters as these fish form the natural food of Mahseer, Murral, etc. They would have a beneficial effect on fresh water tanks and reservoirs as they explore the shallowest depths in search of insect food and are a check on mosquitoes. Four species occur in the waters of our area. Their distinctive characters are as follows:

D. 9. A. 18-20. L. l. 80-87. L. tr. 12-15/6 Length 5-6 ins.	*C. phulo.*
D. 9-10. A. 14-15. L. l. 38-40. L. tr. 6-6½/3 Length 5 ins.	*C. boopis.*
D. 9. A. 13-15. L. l. 80-93. L. tr. 12-15/6 Length 6 ins.	*C. clupeoides.*
D. 9. A. 13-15. L. l. 86-110. L. tr. 17-19/6 Length 7 ins.	*C. bacaila.*

INDIAN TROUT.

Barilius bola (Ham. Buch.).

Day lists 14 species of which 4 are recorded from our area. The fish have the abdomen rounded. The mouth is wide, opening forward with a moderate or deep cleft. Barbels 4 or 2 or none, sometimes small and rudimentary, the dorsal fin is short.

Distinctive characters:

Without barbels.

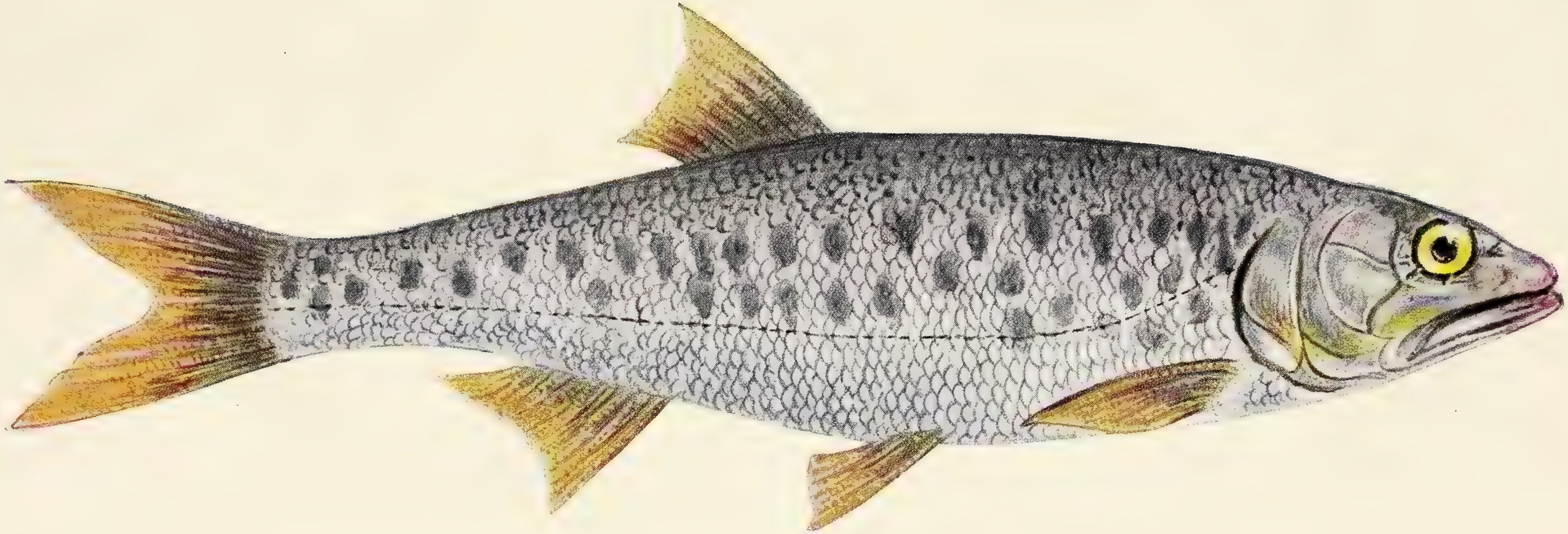
D. 10-11. A. 13. L. l. 88-94. Two rows of blotches.

The snout is pointed with a well-developed knob above the juncture of the lower jaw bones. The snout is deeply cleft; extends well behind the eye.

Colour: Silvery with two or more rows of spots along the side. Some spots on the head. Lower half of the dorsal fin slightly grey. Caudal orange stained with grey and black; pectoral, ventral and anal orange. The colours being somewhat similar to those of a trout. The colouring of the spots varies from blue to bluish green or even black.

This is a very game fish, takes fly well and is good eating. Its introduction into some of the perennial streams of the Deccan would be a great acquisition.

No quotations for the supply of the young fish of this species have yet been reported and the method of obtaining stocks might necessitate a visit being undertaken to the rivers of Central India to make arrangements for supplies. The rivers in which this fish is common are those which flow through C. India and join the River Jumna on the south bank—the rivers in question being the Chambal River, the Sind River and the Betwa River and their tributaries and the territory covered by these rivers in that portion from Neemuch on the West to Jhansi on the East. This fish thrives in elevated lands in rivers with rocky beds, and the river at Neemuch is about 1,476 ft. altitude whilst the height of Lonavla is about 2,000 feet and there appears to be a reasonable hope of this fish thriving in the Lonavla Lakes if stocks could be introduced to those waters. It is a fly-taking fish and 'delicious' on the table and would be a great sport-giving acquisition as it comes into season at the beginning of December and continues upto the commencement of the rains.

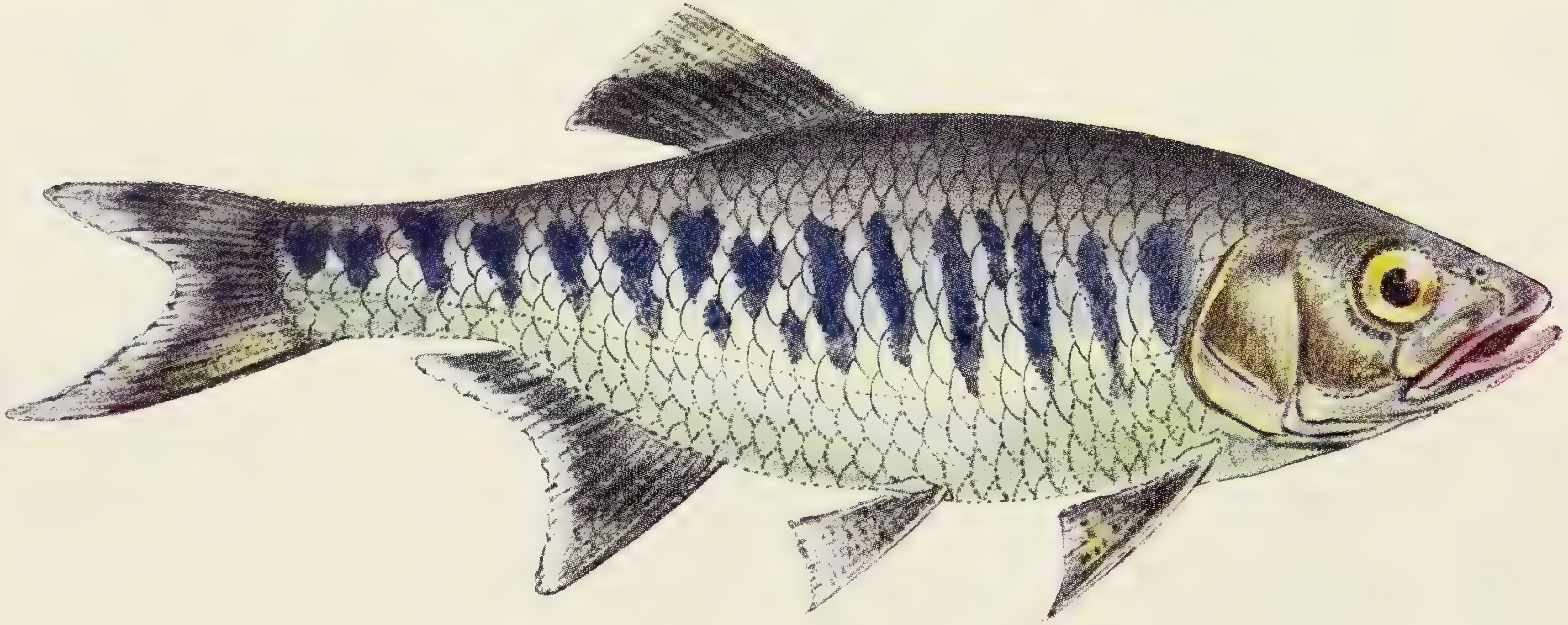


THE INDIAN TROUT

Barilius bola (Ham. Buch.)

(Length up to 1 ft.)

After the drawing in "Fishes of India," Day.



Barilus gatensis (Cuv. & Val.)

(Length up to 6 ins.)

After the drawing in "Fishes of India," Day.

Barilius gatensis (Cuv. & Val).

The present species differs from *Barilius bola* in having a larger number of rays to the dorsal and anal fins and in being barred and not spotted.

Distinctive Characters:

D. 10-12. A. 15-17. L. l. 39-40. 15 vertical bars.

There are 39-40 scales along the lateral line and 2½ rows between it and the base of the ventral fin. The anterior portion of the snout and the sides of the jaw are covered with large glands. There are also some on the lower jaw. Two very minute pairs of barbels are present sometimes.

Colour: Silvery-grey with about 15 vertical bars descending from the back and becoming more or less broken up in the adult. Dorsal, anal fins with dark bases and light margin. The female and young generally have smooth scales whereas most of the adults have one or more rough spots on each. Grows to about 6 inches in length.

The lakes on the Pulney hills are stocked full of this fish and they should do well in the Deccan lakes if introduced. Two species of *Barilius* have been recorded from our area. Their distinctive characters are as follows:—

4 barbels. D. 9. A. 9-10. L. l. 40-43. Short vertical bars, each scale with a black spot in the adult	*B. bendelisis.*
Barbels absent or rudimentary. D. 9. A. 14-15. L. l. 40. Silvery ...	*B. evezardi.*

The Director of Fisheries, Madras, recommends the following species as suitable for introduction into Reservoirs (Lakes):—

Barbus filamentosus (Black Spot).
,, chrysopoma (Olive Carp).
,, carnaticus (Carnatic Carp).
,, chola—length 5 inches.
Cirrhina cirrhosa (White Carp).
Labeo fimbriatus.
,, calbasu (The Labeo).
Chela argentea (Chilwa).

The cost of supplies will be:—

Cost of 5,000 fingerlings of the different varieties of fish at Rs. 4 per 100	Rs. 200
Railway freight for 50 tin carriers each containing 100 fish	,, 200
Railway fare for attendant to and from Bombay ...	,, 150
Porterage, and charges for changing water en route	,, 25
Freight to Madras for empty tin carriers ...	,, 25
	Rs. 600

Labeo calbasu can be supplied by the Madras Fisheries Department.

The fry of Mahseer can be supplied in February.

Another fish, not mentioned before in this paper, because it is indigenous to the sea, which is suitable for introduction to fresh-water tanks is *Megalops cyprinoides*, known in Marathi as the *Warus*. As regards this fish we cannot do better than refer readers to a note by Wallenger which appeared with a plate in vol. xv, p. 719 of the Society's Journal. This fish takes fly readily and apparently adapts easily to fresh-water tanks.

Local Sources for obtaining supplies of Young Fish.

The native fishermen on the Indrayani River at Talegaon near Lonavla could be employed towards the end of the rains in netting supplies of Jerdon's Carp and other suitable fish, and the transport of such supplies in large earthenware chatties carried by bullock cart or by coolie to the lakes would not involve heavy expenditure or much difficulty in arrangement.

MOSQUITO-DESTROYING FISHES.

On parts of the margins of some of the Reservoirs and Lakes the water is very shallow during the dry season of the year, and such places with even only an inch or two of water can produce an abundant supply of mosquitoes which might be dangerous as well as an annoyance. For these very shallow margins, where even the *Rasbora* and *Chilwa* and other small fishes of their dimensions are unlikely to penetrate very far, it is considered advisable to suggest the introduction of some of the smallest Indian fishes of about 1½ inches in length, as these, owing to their very small size, would be able to swim in the shallowest parts and would no doubt, very materially help to keep the propagation of mosquito life down to the minimum. The small fishes recommended are

Barbus phutunio (Ham. Buch.) length 1¼ inches.
Haplochilus lineatus (Cuv. & Val.) length 3 inches.

The publication 'Indian Fish of Proved Utility as Mosquito-Destroyers', price 8 annas and obtainable from The Superintendent, Indian Museum, Calcutta, should also be consulted in this connection, as much useful information is given therein, and doubtless further advice on the subject, if required, would be obtainable from the same source.

PLANTS SUITABLE FOR IMPROVING MARGINS OF LAKES.

The banks and margins of Lakes could be improved in a manner involving no very considerable outlay by the introduction of suitable vegetation.

The Creeping Rush (*Hygrorhiza aristata*). Is a particularly useful plant and has a natural habit of sending out long runners upon the surface of the water from which spring a multitude of rusk-like leaves forming an attraction and resort for ducks and other waterfowl, whilst below the surface is a mass of interlaced roots providing a safe retreat for young fish until they reach fingerling size. This Creeping Rush thus helps very materially to improve any sheet of fresh-water where some protection to the young fish is needed. Supplies are abundant at the Varol Tank—Bhiwindi—Kalyan and no doubt in other places also. Short lengths of a foot or so pushed into the mud at the side of a lake and on the water level is all that is needed to start the growth of the Rush.

Water Lilies (*Nelumbium speciosum* and *Nymphæa lotus*). The planting of these might be done in small patches wherever the depth of water is suitable and thus would be provided shade from the sun's rays for the larger species of fish. 'Gardening in the Tropics'—Woodrow—refers to *n. lotus* as 'this grand water lily with flowers of rosy-red in W. India'. The planting is an easy matter as seed could be inclosed in balls of mud and wrapped up in pieces of canvas and then could be thrown into the water in quantities of half-a-dozen or so in selected spots wherever fairly deep water occurs a few yards from the banks.

Pampas Grass (*Gynerium argenteum*). Grows to a height of 10 feet and is a beautiful ornament for the higher parts of the banks of lakes. It is a perennial, and very easily established and would provide shelter for small game such as birds and hares, etc. Intermixed with it might be planted some of the common Cactus which would greatly improve this SMALL GAME RETREAT. Seed of the Pampas Grass is obtainable from Messrs. Ryder & Son, St. Albans, England, or clumps of old roots can be divided into small pieces and planted in holes specially prepared. The Cactus can be cut into lengths of a few inches and dibbled into small holes, and will be quickly established and in combination with the Pampas Grass will make most useful and ornamental cover for the encouragement of small game.

Sedges (*Cyperus corymbosus*). Sedges of the taller kinds, 5 to 6 feet in height, provide shelter for ducks and small birds and are, as well, an ornamental addition to the margins of lakes inclined to a damp and muddy condition. No difficulty would be experienced in making plantings as pieces of root can be dibbled in a foot or two apart and would be quickly established. The plant is common wherever swampy ground occurs.

Wild Rice (*Zizania acquatica*). Would involve no very expensive work in making plantings. The seed is procurable from Messrs. Ryder & Son, St. Albans, England, at 20 shillings per pound. It is well known as a great attraction to Ducks and other Waterfowl. It is a perennial, and grows to a height of 5 feet. An easy method of making plantings is to place each seed in a small ball of mud, the size of a marble, and when dry and firm, scatter freely in places constantly wet and muddy, if treated in this manner the work can be managed expeditiously and economically.

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS. (ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, M.B.O.U., ASSISTED BY N. B. KINNEAR, M.B.O.U.

PART III.

(*Continued from page 760 of Volume XXXV*).

Brachypteryx major major (Jerdon).

Phœnicura major Jerdon, Madr. Jour. Lit. Sci., vol. xiii, 1844 (after April), p. 170—Nilgiris.

So far the Rufous-bellied Shortwing has only been recorded in the Brahmagherries by William Davison and in the Nilghiris where it is a common resident and breeds about 5,500-7,000 ft. in April and May. We have not been able to trace any record for the 'other hill ranges in S. India' (Davison, S.F., x, p. 372).

No specimens appear to exist of the juvenile plumage which has been described by Cardew (Asian, 2nd. Sept. 1892), nor is anything known of the moults and plumage sequences. From the series of adults of both sexes all in exactly similar plumage in the British Museum we may hazard a guess that the juvenile moults immediately into full adult plumage.

Brachypteryx major albiventris (Blanford).

Callene albiventris Blanford ex Fairbank, P.Z.S., 1867 (Nov.), p. 833, pl. 39—Palni Hills.

The White-bellied Shortwing is confined to the Palni Hills (6,000-7,000 ft.), and the Travancore ranges above 3,000 ft., where they breed from April to June and are of course resident. According to Howard Campbell the young are spotted but no specimens apparently exist and as in the typical race there is only negative evidence to suggest that the juvenile bird moults direct into adult dress.

Tarsiger brunnea brunnea (Hodgson).

Larvivora brunnea Hodgson, J.A.S.B., vi (March 1837), p. 102—Nepal.

Specimens collected.—1616 [♀] 28-3-30, 1685 ♂ 15-4-30 Sankrametta; 1686 ♂ 16-4-30, 1693 ♂ 17-4-30, 1697 ♀ 18-4-30, 1703-4 ♂♂ 19-4-30, 1744 ♂ 29-4-30. Jeypore Agency 3,000-3,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
6♂	14-16	74-80.5	46-53	26-28 mm.
2♀	14-16	73-76	44-51	24.5-25 mm.

As the Blue-Chat is a very marked migrant between the Himalayas and Ceylon its status in the Madras Presidency will be best explained by a general statement.

The most westerly locality in which the typical race is known to breed is the Sufed Koh (Whitehead, Ibis 1909, p. 110). In Kahsmir and the Western Himalayas, as far as Garhwal at any rate, it is a very common summer visitor breeding in a zone between 5,500 ft. to 10,000 ft. Here it arrives early in May and fresh eggs are common about the middle of June. The earliest date for a clutch known to me is 29 May (Buchanan). It starts to move again early in August and the last birds disappear by the middle of October. No birds apparently winter in the foothills on this side.

Eastwards in Nepal and Sikkim the Blue-Chat is less common, and here, though it is in the main apparently a summer visitor, a few birds winter at moderate elevations. East of Sikkim reliable evidence is wanting but this form probably also breeds in N.-Western Yunnan.

On passage the Blue-Chat has only been twice recorded in the Indo-Gangetic plain at Etawah on 4 October 1869 and at Muddapur on 9 October 1879 (Brooks): Blyth however procured a male at Calcutta and Ball shot one in Maunbhum in April 1869. Further south it evidently follows the line of the forest clad ghats on both sides of the Peninsula. In the Western Ghats there are several records for both spring and autumn migration. Along the Eastern Ghats it has as yet only been recorded in spring. On this side there are the following records for the Presidency.

The Survey only met with it in the Vizagapatam Hills. None were seen in February but in March they were quite common at Sankrametta, their numbers increasing towards mid-April. The last specimen was procured on 29 April. These migrants were very fat. They kept to the denser forests and might be met with anywhere in the cool shady parts (La Personne). Jerdon (B. of I, ii, p. 145), killed one in some brushwood in a large mango-grove at Nellore at the end of March and there is a specimen in the British Museum collected by William Davison at Madras in April 1876.

The Blue-Chat is well-known as a winter visitor to the Nilgiris, Travancore and Ceylon in which areas it has been observed from about October until May. The lateness of its stay in this area, was responsible for many years for a belief that it must breed in the Nilgiris, more especially as before leaving the males assumed the black bill of the breeding plumage. The lateness of its spring migration is of course correlated with the late breeding season in the Himalayas.

The Blue-Chat has not yet been recorded from the Palni Hills. In the Nelliampathis, Kinloch considered it somewhat rare, and in Coorg, Betts only saw it once on 22 November 1927.

Larvivora wickhami Stuart-Baker, Nov.-Zool. xxiiii (25 Sep. 1916) p. 298—Chin Hills, can only be regarded as a race of this species. This form was described from a single unsexed specimen which was shot off eggs. The type has the entire upper parts a dull slaty blue, becoming duller and greyer on the edges of the primaries. There is a warm rufous supra-loral streak, and the lower parts from the chin to the breast and flanks are also warm rufous. It therefore approximates to the "washed out" males which are sometimes found in the typical race, though it may of course be an old female. Normally the males only differ from the typical race in their slightly smaller size (6 ♂ bill 15-16: wing 71-74: tail 42.5-48 mm.), but the female has the upper parts washed with blue, thereby partly bridging the difference between *brunnea* and *cyane* in which latter species there is much blue on the upper parts of the female.

Now that the discovery of the squamated plumage of the members of the family *Brachypterygınæ* has led to their transference from the *Timaliidæ* to the *Turdidæ* we are unable to see any reason for the maintenance of this sub-family or indeed any way in which it can be defined. In any case the Blue Chat appears to belong to the *Phœnicurinæ* and should in our opinion be regarded as a connecting link between the genera *Tarsiger* and *Ianthia*. The use of the genus *Larvivora* is merely a relic of the days before the juvenile plumage was known and the bird was relegated to the *Timaliidæ* as the convenient receptacle for taxonomic mysteries.

Hodgsonius phoenicuroides (Gray).

Bradypterus phœnicuroides Gray, Cat. Birds, Nepal (1846), p. 70, App. p. 153—Nepal.

[In the appendix to the 1st edition of the *Fauna of British India* (Vol. iv, p. 481), mention is made of the supposed occurrence of Hodgson's shortwing in the Palnis in winter. We have consulted the original reference (Asian 21 July, 1893), and consider that the record is not sufficiently reliable to be accepted as proof of the apparently still unknown winter quarters of this bird.]

Saxicola caprata burmanica Stuart-Baker. 1922

Saxicola caprata burmanica[1] Stuart-Baker, Bull, B.O.C., xliii (~~1923~~), p. 19—Pegu.

Specimens collected:—8 ♂ 9-4-29, 164 ♂ 30-4-29 Kurumbapatti; 796 ♂ 10-9-29, 816 ♂ 13-9-29 Kodur; 1130 ♂ 17-12-29 Cumbum Valley; 1621 ♂ 28-3-30 Sankrametta 3,000 ft.; 1694 ♂ 17-4-30 Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
7 ♂	13.5-14.5	71.5-73.5	48-53.5	20-22.5 mm.

We have not really much information about the distribution of this race in the Presidency. In the Ghats of the Vizagapatam District La Personne says that it breeds throughout the hills and is common in the more open spaces. Southwards he procured it in the Cumbum Valley and at Kodur. It is given without comment in Dewar's Madras list. In the Shevaroys La Personne found it in small numbers between 3,000-4,000 ft. In the Salem plains it was not common but occurred.

On the western side William Davison met with it two or three times in the Wynaad in cultivated plains country, in particular, noting the difference from the Nilgiri bird (S.F., x, 389). Coorg; Betts' statement that *atrata* was not very common but sometimes to be seen in pairs in open cultivated fields and dry paddy land (Journal B.N.H.S. xxxiii, 544), more than probably refers to the smaller bird which also occurs in Mysore. Specimens in the British Museum from Cannanore and Malabar belong to it definitely.

The breeding season in the presidency is not recorded but appears from La Personne's notes to be about April.

As in the case of so many other common and widely spread species the Pied Bush-Chat has given us considerable difficulty as its differences are mainly those of size and there is considerable intergrading. We have had to modify the opinion expressed in the Kurumbapatti report that our specimens belong to *S. c. atrata*.

In the *New Fauna*, four races are recognised, viz., *S. c. caprata* (Luzon, Timor, Lombock, etc.), *S. c. burmanica* (Assam, Burma, Yunnan), *S. c. atrata* (S.-W. India and Ceylon) and *S. c. bicolor* (Northern India generally). Of these only the last *S. c. bicolor* shows colour differences, consisting in a greater extent of white on the abdomen in the male, and perhaps a generally paler colouration of the female and young. The other three races all have the white on the lower plumage of the male reduced to a very small patch on the lower tail-coverts and vent, and differ merely *inter se* in measurements.

The Survey series however made a revision of the races imperative; for whilst our birds agree with the northern race *bicolor*[2] in size, they have the colouration of the large-billed southern race and thereby agree with the description of *burmanica*, which is admittedly not very distinct from the typical form.

In the *New Fauna* (vol. ii, p. 25) Stuart Baker asserts that *burmanica* is distinctly larger than *S. c. caprata*. With this we cannot agree. The measurements of a series from Luzon, Lombock, Timor and Cebu on the one hand and Burma on the other hand are as follows:—

	Bill.	Wing.	Tail.
11 ♂ *S. c. caprata*	14-15	64.5-75	47-54.5 mm.
10 ♂ *S. c. burmanica*	13.5-14.5	66-73	48.5-53 mm.

The only valid difference in size therefore lies in the bill, which is more marked than these measurements show baldly stated. All but two of the *caprata* have the bill 15-15.5 mm. Our Survey series agree absolutely with the Burmese series in measurements and in the extent of white on the vent.

At the same time we are by no means certain that, if *burmanica* and *caprata* are to be kept separate, it is correct to keep both the Ceylon birds and the birds from the hill ranges of S.-W. India under one name *atrata*. A series from the Nilgiris, Palnis and Travancore ranges measure:—

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[1] We have not been able to see specimens from Chota Nagpur to verify our suspicion that this name is antedated by *Motacilla sylvatica* Tickell, J.A.S.B. vol. ii, p. 575—Borabhum.

[2] 14 ♂ *S. c. bicolor* from the Punjab measure: Bill 13.5-15; Wing 70-75; Tail 49-53.5 mm.

	Bill.	Wing.	Tail.
16 ♂	14.5-18	72-78.5	52.5-59.5 mm.

Of these all but two (14.5 and 15) have the bill 16 mm. and over.

A small series from Ceylon measure:—

	Bill.	Wing.	Tail.
6 ♂	17-20	77-81	54.5-58 mm.

And this difference would probably be accentuated if the series available was as large as that from S.-W. India.

The local migrations of this species require study. To large areas of the north-west it is almost entirely a summer visitor, and conversely a winter visitor to much of the country on its southern and south-eastern boundaries. When these movements are understood the boundary between *bicolor* and *burmanica* will probably become much more intelligible. The brown fringes often found in the plumage of the male are of no racial significance. They are a characteristic of first winter birds, which may also be recognised by the browner wing quills and primary coverts with fulvous edges, which remain unmoulted from the juvenile plumage.

Saxicola caprata atrata Blyth.

Pratincola atrata Blyth, J.A.S.B., xx, 1851 (after March), p. 177—Ceylon.

Not obtained by the Survey. This large billed strictly resident Bush-chat is one of the most abundant and familiar species in the Nilgiris, the Palnis and the Travancore Hills as far south as Peermade. In this area the breeding season commences as early as February and continues to the end of May but most nests contain fresh eggs about the end of March and the beginning of April. The post-nuptial moult is correspondingly early in May and June.

Saxicola torquata indica (Blyth).

Pratincola indica Blyth, J.A.S.B., xvi (1847), p. 129—India, Calcutta.

There appears to be no definite record that the Indian Stone-chat occurs within the Presidency limits. Stuart Baker (*New Fauna*, ii, p. 29) says that it occurs 'throughout Northern India to the hills in the North of Mysore and Travancore' but we can trace no record on which this statement is based and its meaning is certainly not very clear. Inglis and Baker (*Birds of South India*, p. 35) include the Stone-chat on the strength of this statement but specifically state that they can find no record of it in the Presidency. In the *Old Fauna* (vol. ii, p. 62) Oates says that he had seen no specimen from South of Belgaum though Hume said (S. F., x, 389) that it was reported common in S.-W. Mysore in the cold weather.]

Phoenicurus ochrurus rufiventris (Vieillot).

Œnanthe rufiventris Vieill, *Nouv. Dict. D'Hist., Nat.*, Nouv. ed. xxi (1818), p. 431—Bengal.

Specimens collected:—906 ♂ 12-10-29 Seschachalam Hills 2,000 ft.; 1077 ♂ 10-12-29 Cumbum Valley.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	15	89-89.5	63-65	23.5-24.5 mm.

The Black Redstart appears to be an uncommon winter visitor in the Madras Presidency. There are only four records of it which I can trace viz:—the above two specimens collected by the Survey, Dewar's statement that there are a good many in winter at Madras, and a male (now in the British Museum) collected by William Davison at Segore on 22 February 1881. Of this he writes (S. F., x, 389):—'Only a winter visitor to the south and even then not numerous. I have never known it ascend the hills (Nilgiris). I have seen it most often about the stony ground at the base of the hills and procured specimens near Segore.' The three males examined all belong to this race.

As in so many other cases it is rather difficult to disentangle the correct winter distribution of *rufiventris* and *phœnicuroides* in the Indian Empire as these two races are very close to each other and there is complete intergrading between them. I have however arrived at somewhat different conclusions to those given in the *New Fauna*.

True *phœnicuroides*, in my opinion, is confined in India as a winter visitor to the north-west, that is to say, to N.-W. F. Province, Baluchistan, the Punjab, Sindh, Rajputana, and the Western United Provinces. This form is remarkable for the heavy ash-grey and ash-brown fringes on the upper parts which largely obscure the black, and on the crown indeed virtually replace it. It is smaller than the next. Ticehurst gives the wing in ♂ of Sindh examples as 80-84 mm., 17 ♂ from the Punjab have wings 81-86.5, with the majority under 85.

P. o. rufiventris, on the other hand, has the fringes greatly reduced in extent so that it appears far blacker on the upper parts and particularly on the head. It is also larger; ♂ wing 86-93 mm. The female is usually darker in colour and has the abdomen often tinged with chestnut. While birds which winter in the United Provinces are intermediate in character (though even at Muddapur they are closer to *rufiventris* as clearly shown by Brook's large series in the British Museum), I must attribute to this form all the specimens I have examined in the Peninsula from Jhansi, Saugor, Mhow and Khandesh and south and east of those localities, up to Assam, Manipur and Upper Burma (where however it is not common). Along the base of the Himalayas stragglers occur further west than this distribution e.g. ♂ 1-10-1866 Naini Tal (Brooks), ♂ 1869 Saharunpur (Hume Coll.), ♀ March 1876 Delhi (Hume Coll.) and according to Meinertzhagen ♀ 3 October Rawalpindi (*Ibis* 1927, p. 584).

Cyanosylvia suecica (Linnæus).

Motacilla suecica Linn., Syst. Nat. x ed., vol. i (1878), p. 187—Sweden.

Specimens collected:—1101 ♂ 13-12-29, Cumbum Valley; 1295 ♀ 23-1-30, Godaveri Delta.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
♂	14.5	75.5	53	27 mm.
♀	15.5	73.5	52	27 mm.

The Bluethroat is known to reach Ceylon sometimes in winter and it is moderately common in India certainly as far south as Hyderabad and Mysore. One would therefore expect it to occur in the Presidency but the only record which we have been able to trace—in addition to the two specimens obtained by the Survey—is Hume's statement (S.F., x, 390) that it is common in the Wynaad.

We are unable to attribute these two specimens with certainty to any particular race, and after a good deal of study of this species remain very doubtful how far it is possible to identify racially the great majority of Bluethroats obtained in India. There are two reasons for this. First of all there is considerable doubt as to the number of subspecies which should be recognised. The latest review is by Mr. A. Tugarinov (Ann. du. Mus. Zool. de l'Acad. des Sciences de l'URSS, 1928), who recognises eleven subspecies as occurring in Asia alone. We have consulted this paper and must admit that we are unable to appreciate the supposed differences between several of the eleven subspecies. The material in England is however insufficient either to support or disprove Mr. Tugarinov's views and they cannot be lightly set aside as he has had the advantage of studying the immense Asiatic collections in the Leningrad Museum. In any case the differences between the forms are slight, and often only recognisable with certainty in series from the breeding area. As the distinctive breeding dress of the male Bluethroat is only assumed about March, it is evident that when the actual number of races is still in doubt, the current statements regarding their distribution in India are based merely on supposition.

The account of the Bluethroats in the *New Fauna* is, of course, in complete confusion and for some reason was not corrected in the concluding volumes, though Osmaston (J.B.N.H.S., xxxi, p. 983; *Ibis* 1925, p. 683) and Meinertzhagen (*Ibis* 1927, p. 589) showed beyond all doubt that the white-spotted and red-spotted birds breeding in Ladakh belong to one dimorphic species. This conclusion has been confirmed by other observers, including the writer.

Calliope calliope (Pallas).

Motacilla calliope Pallas, *Reise Russ. Reichs.*, iii (1776), p. 697—'a Jenisea usque ad Lenam'.

Specimens collected:—1458 [♂] 2-3-30, 1502 ♀ 8-3-30, 1549 ♀ 16-3-30, 1613 ♂ 27-3-30 Sankrametta 3,000-3,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	16.5-17	79-80	58-60	30-31 mm.
2 ♀	15-16	72.5-76.5	58.5-61.5	26.5-29.5 mm.

These birds were common at Sankrametta during the month of March but in April their numbers decreased considerably and by the last week in April they had practically left the district. The specimens obtained were extremely fat. They were chiefly observed on a scrub-covered knoll where they hunted for food in company with *Acrocephalus*, *Dumetia* and *Franklinia* (La Personne).

These specimens and La Personne's note furnish the only records of the Rubythroat within the Presidency and its normal winter quarters lie to the east of the Bay of Bengal. It has however been recorded in the Peninsula at Raipur (Hume, S. F., vii, p. 216), in the Balaghat at Lamta (D'Abreu) and once in the Satpuras (Ball, S. F., ii, p. 413), while Jerdon informs us (*B. of I.*, vol. ii, p. 150) that he once saw one take refuge on a ship a little south of Bombay in the month of November.

Saxicoloides fulicata fulicata (Linn.)

Motacilla fulicata Linn., Syst. Nat. vol. i ed. xii 1766, p. 336—Philippines in error, Ceylon.

Specimens collected:—1 ♀ 9-4-29, 31 ♂ 12-4-29, 153 ♂ 29-4-29 Kurumbapatti; 441 ♀ 18-6-29 Harur 1,000 feet; 502 ♂ 504 ♀ 4-7-29, 511 ♂ 5-7-29 Kalai, Trichinopoly; 551 ♂ 18-7-29, 569 ♂ juv. 20-7-29 Gingee; 716 ♂ 20-8-29 Palkonda Hills 1,000 feet; 813 ♂ 13-9-29 Kodur; 850 ♂ 29-9-29, 859 ♀ 1-10-29, 868 ♀ 3-10-29 Seshachalam Hills 2,000 feet; 949 ♂ 31-10-29, 973 ♀ 4-11-29, 1032 ♂ 25-11-29 Nallamalai range 2,000 feet; 1109 ♂ 14-12-29, 1175 ♂ 26-12-29, 1183-4 ♂♂ 27-12-29 Cumbum Valley.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
14 ♂	14.5-16.5	70-77	60-67	24.5-27 mm.
8 ♀	13.5-15.5	69.5-73	58-61.5	23.5-25.5 mm.

The Black-backed Indian Robin appears to be very generally distributed and resident throughout the eastern side of the Presidency from the Krishna Valley southwards, occurring upto a height of about 2,000 ft. On the western side it is less general, doubtless avoiding the areas of more heavy rain, and the records here may be enumerated. For Coorg Betts had only one doubtful record, though there is a specimen in the British Museum obtained in this state. In the Nilgiris it is common on the slopes up to 3,000 ft. according to William Davison. Hume (S.F. v, p. 406), records it at the E. base of the Palnis in June. In Travancore Ferguson says that it is not common but it may be found in the low country and he had seen it at 2,000 ft. in the hills in the dry season.

The breeding season in the Presidency is not very definitely recorded but in Salem District La Personne considered it was breeding in April and May and he found a chick in the nest at Kurumbapatti on April 15th.

We may remark here that the only female which we have seen of this species from Ceylon is quite different to Peninsula birds being very dark, almost black in colour. If this difference is found constant, when a series is available for examination, the name *fulicata* will have to be restricted to the island race and a fresh name found for the birds of Southern India below Goa and the Krishna River.

Saxicoloides fulicata intermedia Subsp. nov.

Specimen collected:—1579 ♂ 22-3-30, Sankrametta, 2,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♂	14.5	73	64.5	26 mm.

In the Vizagapatam district La Personne reports that the Indian Robin was quite common in the Padwa valley, ascending the ghats to about 3,000 ft. It was also common and breeding in the plains below. The single specimen obtained agrees with three in the British Museum obtained by Blanford at and near Ellore, but we have no other information about this species in the Presidency north-east of the Krishna valley.

It has long been recognised that Indian Robin falls really into three separate races, the Brown-backed in the north, the Black-backed in the south and in between an intermediate which cannot correctly be assigned to either of those forms (see Hume S.F. iii. 474). This intermediate race is easily recognisable if male birds of the three races are set out in comparable order, that is in sequence of months. The intermediate form has the black-back and crown heavily washed with brown, but this brown is not the grey brown of the north-western form but it is far darker, more chocolate in tint. The female agrees with the female of *fulicata*. As this difference is correlated with distribution it is clearly racial and should be recognised. The only difficulty in the matter lies in the correct attribution of the name *cambaiensis*,[1] whether this should apply to the intermediate or the north-western form. Hume clearly considered that this name applied to the intermediate, to which he attributed a range from Sindh, Cutch, Kathiawar, W. Jodhpur and the neighbourhood of Mt. Aboo, Deesa and Ahmedabad. We have however been able to examine in addition to the specimens of the Hume collection a large number of fresh specimens, and would in consequence restrict the range of the true intermediate somewhat differently, namely a broad belt right across the centre of the Peninsula bounded on the north by a line from the R. Tapti to Vizagapatam district, and on the south by the Krishna River. Birds from Sindh, Cutch, Deesa and Mount Aboo are certainly closer to the pale brown-backed bird of the north-west and the name *cambaiensis* may therefore be retained as heretofore for that race. This leaves the intermediate race without a name and we therefore propose to call it

Saxicoloides fulicata intermedia subsp. nov.

Type ♂ 21- 4.69, Rahuri Ahmednagar. Collected by Rev. H. J. Bruce. British Museum No. 1886, 10-1-420.

To this form belong the above mentioned specimens from the north-east of the Presidency.

Copsychus saularis saularis Linnæus.

Gracula saularis Linn., Syst. Nat. ed. x (1758), vol i, p. 109—Asia = Bengal.

Specimens collected:—71 ♂ 17-4-29, Kurumbapatti; 202 ♂ 11-5-29, Shevaroy Hills 3,500 ft.; 364 ♂ 8-5-29, Chittiri Hills 2,000 ft.; 586 ♂ 23-7-29 Gingee; 690 ♀ 14-8-29, 733 ♀ 23-8-29, Palkonda Hills 1,000 ft.; 916 ♀ 14-10-29, Seshachalam Hills 2,000 ft.; 942 ♂ 30-10-29, 950 ♀ 31-10-29, 951 ♂ 1-11-29, 990 ♂ 9-11-29, 1026 ♀ 22-11-29, Nallamalai range 2,000 ft.; 1250 ♀ 14-1-30, 1255 ♂ 15-1-30, 1289 ♂ 22-1-30 Godaveri Delta; 1437 ♂ 25-2-30 Anantagiri 3,000 ft.; 1566 ♂ 19-3-30, 1581 ♂ 22-3-30, 1614 ♂ 27-3-30, 1623 ♂ 28-3-30, Sankrametta 2,000-3,500 ft.; 1747 ♂ 30-4-30, Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
15 ♂	21-22.5	96-104	79-92	27-30.5 mm.
6 ♀	21.5-22	94-97.5	79-88	27-29 mm.

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[1] *Sylvia cambaiensis* Latham, Index Orn. ii (1790), p. 554—Guzerat, India.

All Magpie-Robins collected by the Survey belong to one very regular type which is found throughout practically the whole of India, except the S.-W. Punjab, Sindh and W. Rajputana where the species does not occur. In this the male has the three outer tail feathers pure white and the fourth feather largely white with a black line on the edge of the inner web and extreme base, with sometimes a fine black line on part of the edge of the outer web.

The amount of black on the fourth feather starts to increase roughly speaking about Vizagapatam, Bengal and the Duars and from those areas grading into the Malayan race *C. s. amœnus* begins. The Ceylon race *C. s. ceylonensis* may be accepted. We can see no real difference in the bills or tail marking, though occasional birds may have a little more black on the fourth tail-feather. But the females certainly have the upper plumage blacker and more glossy, with the throat and breast a darker grey. Birds from Southern India (Travancore, Nilgiris and Bangalore), suggest intergrading between *C. s. saularis* and *C. s. ceylonensis*.

The Survey appears to have found the Magpie-Robin very generally distributed from sea-level, occurring even in the wooded islands of the Godaveri Delta, upto about 4,000 ft. on the various ranges. This seems also to be the case throughout the rest of the Presidency though in Travancore Ferguson regarded it as more particularly a bird of the hills.

Nothing seems to have been recorded about the breeding season in the Presidency except that in Travancore Ferguson gives it as February and March and in the Vizagapatam Hills La Personne considers it was breeding in March and April. In the Chitteri range he found fledged young on 8th May still with the parent.

Kittacincla malabarica malabarica (Scopoli).

Muscicapa malabarica Scop., Del. Flor. et Faun. Insubr. ii (1786), p. 96—Mahé, Malabar.

Specimens collected:—29 ♂ 11-4-29, 33 ♂ 12-4-29, 109 ♀ 27-4-29, Kurumbapatti; 306 ♂ 2-6-29, 423 ♀ 15-6-29, Chitteri range 2,000 ft.; 666 ♂ 8-8-29, 686 juv. 13-8-29, 707 ♂ 18-8-29, Palkonda Hills 1,000 ft.; 1394 (♀) 16-2-30, 1490 ♂ 6-3-30, 1756 ♂ 2-5-30 Anantagiri 3,000 ft.; 1456 ♂ 2-3-30, 1638 ♂ 1-4-30 Sankrametta 3,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
9 ♂	18-20.5	91.5-99	160-200.5	24.5-27 mm.
3 ♀	17.5-18.5	85-88	126	23.5-24.5 mm.

No. 1394 although marked ♂ is certainly a ♀. It is in any case albinistic, the black of the plumage replaced by dull sooty brown, the chestnut by fulvous white.

There has been endless confusion over the name of this well-known bird. The earliest name which refers to it is the *Muscicapa malabarica* of Scopoli (1786). This is not based on Latham's Long-tailed Thrush from Pulo Condone, as stated in the *New Fauna*, vii, p. 114 footnote, but on Sonnerat's "Les Gobe-mouches á longue queue de Gingi (*Voy. Aux. Ind.* etc. p. 196)." It is true that by a mistake Scopoli refers to plate III which is of a Drongo, but the description is quite clear and the name must stand as already pointed out by Richmond (Proc. U. S. Nat. Mus. xxvi, 1903, p. 512). Sonnerat's specimen came from the Malabar Coast, so the neighbourhood of Mahé is evidently the type locality. Mr. Stuart Baker says that Malabar is an error and that Pulo Condone must stand, but this is apparently only due to confusion between Sonnerat and Latham. In consequence of this mistake Mr. Stuart Baker proposed the name *indica*[1] for the Indian bird with Bhutan Duars as type locality. To this point we will return later.

It is far from correct to say that the Shama is found practically throughout the whole of India. It is absent from at least half of the area of the country. As at present recorded it is confined to the Sub-Himalayan tract from Ramnagar, S. W. of Naini Tal, (B. B. Osmaston, J. B. N. H. S., xxvi, 427) eastwards to Assam, the Rajmahal Hills and a tract of country from Lohardugga and Madnapur down to Raipur and the Vizagapatam district, where La Personne found it at Sankrametta and Anantagiri at altitudes of 3,000-3,500 ft. From here there is no record until the Palkondah Hills 1,000 ft., the Chitteri range 2,000 ft. and Kurumbapatti 1,000 ft. at all of which places it was found by the Survey. On all this side according to Jerdon it is less abundant than on the western side where it is found from Travancore up to Khandalla.

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[1] *Kittacincla macroura indica* Stuart Baker *Fauna*, Brit. Ind. 2nd ed., ii, April 1924 (published 7th May), p. 118—Bhutan Duars.

In Travancore according to Ferguson it is not common, nor does it ascend the hills. The only record for the Palnis is at the eastern base where Fairbank heard it singing. Davison found it once or twice in bamboo jungle a few miles from Seegore at the foot of the Nilgiris and he obtained a male on 15 April 1881 at the foot of the Brahmagheries. Jerdon considered it common in the Wynaad, and in Coorg, according to Betts, it is not uncommon but local in its distribution. Beyond our limits on this side it becomes more numerous up the line of the Western Ghats.

There is no very definite information about the breeding season in our limits. The specimens obtained at Kurumbapatti in April appeared by their organs to be breeding and in the Palkondas a bird collected was still in juvenile plumage on 13 August.

The Survey series agree absolutely with birds from the Western side and therefore may be safely attributed to the typical race. Twelve males from the West have tails measuring 160-207 mm., so there is nothing unusual about a tail variation of 160-200.5 mm. for our 9 males.

Birds from the Duars, Assam and Burma have undoubtedly much shorter tails. Twelve males from this area have tails varying from 136-162 mm. and we see that Stevens (J.B.N.H.S., xxx, p. 356) also comments on the shortness of the tails in his Assam series. We think therefore that the name *indica* may be usefully kept for this short-tailed race.

It is worth remark that the few Ceylon specimens we have examined suggest that in that island there is again a short-tailed form as if in this as in many other species there is an approximation between Ceylon and Malay birds, rather than between Ceylon and Indian.

Turdus simillimus simillimus (Jerdon).

Not obtained by the Survey.

The Nilghiri Blackbird is, of course, very abundant on the plateau of the Nilgiris while Coonoor and Ootacamund are particularly well-known localities for it. According to William Davison it only extends a small way down the slopes and that in small numbers. A single specimen collected by Davison in the Brahmagherries (♀ 19-4-81) suggests that Betts is correct in assigning to this form the shy and scarce resident Blackbird of Coorg (J.B.N.H.S., xxxiii, 544). Taylor states that it is occasionally seen on the hills of Western Mysore (S.F. x. 459). The records for the Palni Hills (Fairbank, S.F. v. 403, Terry; S.F. x. 474), are due doubtless to mistakes in identification of *bourdilloni.*

The breeding season in the Nilgiris is prolonged, from March until August. A clutch of unspotted eggs is recorded by Cardew (J.B.N.H.S., x. 148).

There appears to have been a good deal of confusion over the question of the Blackbirds of Peninsular India and Ceylon and we have been most carefully into the available specimens and records to see if we can throw any light on the group.

In the *New Fauna* Mr. Stuart-Baker (vol. ii, p. 123) considers that three Indian forms *simillima*, *nigropileus* and *bourdilloni* as well as the Ceylon bird *kinnisii* should all be treated as races of *Turdus merula* of Europe, and this treatment is apparently adopted in order to provide some sort of intergradation between the pure black *T. merula merula* with its obvious races and the white collared *albocinctus* which he also considers a race of *Turdus merula*. This treatment does not commend itself to us, even with the addition of the theory of successive migrations northward and south which he uses to explain how the intermediates between two adjacent Himalayan forms are to be found in the hills of a different and older geological system. His statement that 'in no cases do the breeding ranges of any two of these birds overlap' is negatived by his own inclusion of the Palnis in the range of both *simillima* and *bourdilloni*, whilst the Nilgiris form the type locality for both *simillima* and *nigropileus*.

The first point that emerges from an examination of the problem is that while all observers are very positive that in southern India more than one species of Blackbird occurs in a given locality the point cannot be substantiated with skins. At Manzeerabad Taylor says that *nigropileus* is common all over the district but that *simillima* occurs in the Hills. Terry gives three forms in the Palnis. Kinloch says that *nigropileus* is very common on the Nelliampathis but that it is replaced in one area by *bourdilloni*. Yet recourse to the British Museum series seems to prove that all Nilgiri birds are *simillinus*, all Palnis and Travancore birds are *bourdilloni* and all Ceylon birds *kinnisii*. There is no specimen of *nigripileus* from south of Kanara except two birds from the Tweeddale collection with the unsatisfactory locality 'Malabar'. The three first forms are very close together and single specimens of either of them are often difficult to identify correctly; but we are loath to accept the obvious and facile explanation that the overlapping of records is due entirely to wrong identification in face of the unanimity of all observers that more than one form occurs in most of the localities. Moreover amongst the few specimens we have been able to assemble from other sources than the British Museum we have received from Col. Sparrow a most distinct example (♂, 14 March, 1914) of *nigropileus* which he collected personally in the Cardamum Hills, Travancore.

It is not improbable, of course, that out of the breeding season one or more forms (probably *nigropileus* see S.F., iii, 470) move about and trespass on the breeding range of others, and this is probably the correct explanation of the difficulty. At any rate in view of the similarity of the plumage patterns, the way they intergrade into each other, and the absence of proof that any two forms breed in one area, we propose to consider them all as races of one species, which we emphatically reject as having any connection with the *Turdus merula* group of the Palaerctic area.

Luckily we know that the type of *Merula nigropileus* Lafresanage, Rev. Zool. 1840, p. 65—Inde, Plat. des Nielgheries is in the Museum of Comparative Zoology, Cambridge, Mass. U.S.A. (*Vide* Bull. Mus. Comp. Zool., Harvard Coll., lxx. No. 4, March 1930, p. 327). Its re-examination seemed desirable in view of the overlapping of localities and Mr. Kinnear accordingly sent a pair each of *simillima* and *nigropileus* (anct.) to Mr. Bangs with the request that he would compare them with the type. This Mr. Bangs kindly did and he was able to reply that Lafresnage's type is an *extremely typical* example of *simillimus* and 'could not possibly be confused with the bird to which the name *nigropileus* has been applied, if one had both forms before him together with Lafresnage's type'. *Nigropileus* therefore becomes a Synonym of *simillimus* and removes difficulty that two forms had one type locality. This leaves the Black-capped Blackbird as fully described by Oates (Old Fauna, vol. ii, p. 126) without a name and we therefore propose for it.

Turdus simillimus mahrattensis.

Type.—B.M. 1886. 7. 8. 274 ♂ 16 Ap. 1870 Mahableshwar collected by S. B. Fairbank.

We propose therefore to group the non-Himalayan Blackbirds as follows*:—the breeding range only is given.

Turdus simillimus simillimus Jerdon.

Turdus simillimus Jerdon. Madr. Jour. Lit. Sci., vol. x (Oct. 1839), p. 253—Nilgiris.

The Nilgiris and Brahmagherries, probably extending to the higher ranges of Western Mysore.

Turdus simillimus bourdilloni (Seebohm).

Merula bourdilloni Seebohm, Cat. Birds Brit. Mus., vol. v (1881), p. 251, pl. xv—Colathoorpolay Patnas, Travancore.

Nelliampathi (?) and Palni Hills, Travancore Hills above 3,000 ft.

Turdus simillimus Kinnisii (Blyth).

Merula kinnisii Blyth, J.A.S.B., xx (1851), p. 177—Newara Elia, Ceylon.

Confined to Ceylon.

Turdus simillimus mahrattensis nom-nov.

Mount Abu; Western Ghats from Khandesh to Malabar.

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* *Merula erythrotis* Davison, Ibis 1886, p. 205.—From Hills to east of Cannanore, is merely based on a stained specimen of either *simillimus* or *bourdilloni*.

Turdus simillimus spencei Subsp. nov. (below).

Eastern Ghats. It is at present uncertain whether the form occurring in the Central Provinces belongs to this or the last.

It should be noted that in the last two forms the second primary is longer than the seventh, whilst in the first three forms the second primary is almost always shorter than the seventh primary and other considerably so.

Turdus simillimus bourdilloni (Seebohm).

Peculiar to the Madras Presidency. Bourdillon's Blackbird is common, according to Kinloch on the Lily Downs of the Cochin Nelliampathis (J.B.N.H.S., xxix, 565), but no specimens from that area have apparently been critically compared. On the Palnis it is quite common and resident at about 4,000 ft. and upwards. In Travancore it seems to be very generally distributed and not uncommon over all the ranges from about 3,000 ft. upwards. Bourdillon says that it is found in dense scrub jungle.

The breeding season is recorded as April to June.

Turdus simillimus mahrattensis nom. nov.

The status and range of the Black-capped Blackbird in the Madras Presidency is somewhat obscure. Its supposed occurrence in the Nilgiris has already been shown as due to confusion over the type specimen.

In the Nelliampathies according to Kinloch (J.B.N.H.S., xxvii, 941) it is very common, generally terrestrial and in pairs, though large flocks occur in the Lantana bushes. This is perhaps in winter only if the identification is correct.

The published records for the Palnis and Travancore under the name of *nigropileus* appear to refer really to *T. s. bourdilloni* but, as remarked *supra*, we have examined an undoubted specimen, ♂ 14 March 1914, collected by Colonel Sparrow in the Cardamum Hills, Travancore.

Turdus simillimus spencei Subsp. nov.

Specimens collected:—935 ♂ 20-10-29 Seshachalam Hills 2,000 ft.; 969 [♂] 4-11-29 Nallamalai range 2,000 ft.; 1468 ♂ 4-3-30, 1459 ♂ 2-3-30, 1636 ♂ 1-4-30 Sankrametta 3,500 ft.; 1705 ♂, 1707 ♂ 19-4-30, 1716 ♂ 21-4-30 Jeypore agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	25-26.5.	122-132.	91-102.	30.5-33 mm.

La Personne reports that this Blackbird was common at Anantagiri and abundant at Sankrametta, frequenting wooded ravines and water courses. The organs were enlarged in April. This is probably the form met by Jerdon (B. of I, i. p. 523), at Nellore and in the neighbouring Ghats.

The discovery of yet another form of Blackbird in Peninsular India is of considerable interest. The fine series of eight males collected agree *inter se* in having the upper plumage very similar to *T. s. simillimus* but paler throughout and with the cap not so pure a black; whilst the lower plumage agrees with that of *T. n. nigropileus* except that the faint viscous flush of that bird is replaced by a cold grey tint.

Type.—No. 1707 ♂ 19-4-1930, Jeypore Agency 3,000 ft., British Museum Register No. 1932-6-1-1.

We have much pleasure in naming this bird after Sir Reginald Spence, the Honorary Secretary of the Bombay Natural History Society, whose interest has done so much to make the E. Ghats Survey a success.

Turdus unicolor Tickell.

Turdus unicolor Tickell, J.A.S.B., ii (Nov. 1833), p. 577—Bansighar, Borabhum.

Specimens obtained:—1391 ♀ 14-2-30, 1411 ♂ 19-2-30 Anantagiri 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
♂	22	117.5	75	31 mm.
♀	21.5	119	82	31 mm.

Jerdon's statement (B. of I., i, p. 519) that he procured Tickell's Ouzel from the E. Ghats and the above two specimens obtained by the Survey are the only records for the Presidency.

Tickell's Ouzel breeds very commonly in Kashmir and the Western Himalayas from Chitral to the valley of Nepal. We can find no authority for the statement that it breeds in the Eastern Himalayas, but in winter it appears to have a south-easterly migration in the course of which it moves to the Sikkim Himalayas at low elevations and the jungles from Chota Nagpur to Raipur and the Upper Eastern Ghats. Like other Thrushes it is an erratic vagrant and to this are due isolated winter records at Quetta (St. John), Jacobabad 7 Feb. 1867 (S.F., i, 179), Sambhur Lake (Adam, S.F., i, 877), Mt. Aboo 19 Sept. 1874. (S.F., i, iii, 470 and v, 228) and Khandala November (Blanford, S.F., iv, 257).[1]

Geokichla wardii (Blyth).

Turdus wardii Blyth, J.A.S.B., vol. xi (after September, 1842), p. 882—Mysore below Seegore Pass.

Specimen procured:—1698 ♂ 18-4-30 Jeypore Agency 3,000 ft.

Measurements—

Bill.	Wing.	Tail.	Tarsus.
27	110	75	27 mm.

Extremely fat. In company with the Blackbirds in a heavily afforested ravine. Another specimen was seen on 26 April at Sankrametta in flight across the valley, taking a north-easterly direction. (La Personne.)

The Pied Ground Thrush breeds at moderate elevations in the Himalayas from Kulu and Simla eastwards and in northern Assam. It is a strong migrant and winters in Ceylon. All the records between these two areas, with the exception of a somewhat doubtful one for the Konkan (S.F., ix, p. 399), refer to the Presidency on passage, and suggest that the bird travels by the E. Ghats route.

The two birds met by La Personne were evidently on passage; Jerdon (B. of I. i, 521) obtained 2 birds on migration in a large mango-grove at Nellore at the beginning of April. The type was obtained (Jerdon, Ill. Ind. Orn. pl. viii, 1845, pt. 1) by Mr. S. N. Ward, M.C.S., on the tableland of Mysore and immediately below the Seegore Pass of the Nilgiris, 'during the cool season'. Two specimens in the Hume collection were obtained on 10 March 1881 'below Kotagherry' and on 8 April 1876 by William Davison in the Nilgiris.

Kinloch records a single male in the Nelliampathies but gives no date though he considered it on passage (J.B.N.H.S., xxvii, 944). Terry procured a female on 1st March and a male on the 3rd March, in thick sholas about a mile apart at Pulungi in the Palnis (S. F., x, 474). Ferguson shot one in February on the High Range in Travancore (J.B.N.H.S., xv, 466). In Ceylon its numbers are said to vary a good deal in different years.

Geokichla citrina citrina (Latham).

Turdus citrinus Latham, Index Orn. (1790), i, p. 350—India, Cachar.

The inclusion of this race in our Presidency list depends on Jerdon's statement that it occurs in Gumsoor (B. of I., i, 518) and an old specimen marked 'Madras' from the Indian Museum is now in the British Museum. Whether town or presidency is meant, we need not hesitate to accept both records as in winter this race is a confirmed wanderer.

The Orange-headed Ground-Thrush breeds throughout the foothills and lower middle Himalayas from Murree to Sikkim, and in Assam and Burma eastwards. In Nepal and the Western Himalayas it is a summer visitor, growing scarcer and scarcer west of Mussoorie until Murree is its westerly recorded limit. The date of arrival is not accurately recorded—probably late April and May—and the return passage is from August to October. In the Eastern Himalayas and Assam it appears to be largely resident along the foothills, moving in summer also into some of the inner Himalayan valleys.

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[1] We cannot trace either the record or the specimen from Travancore referred to in *New Fauna*, vol. ii, p. 139.

The migratory birds of the western Himalayas evidently winter anywhere from the Doon to Chota Nagpur and Calcutta, thus infringing on the territory of *cyanotus*. Stragglers wander far afield as is shown by the following isolated records:—Rohtak ♀ Nov. 1910 (A. H. Marshall); Sambhur Lake ♀ 10 March (Adam, S. F., i, 377); Ratnagiri 5 January 1878 (Armstrong, S. F., ix, 62) and Ceylon (4 records).

Geokichla citrina cyanotus (Jardine and Selby).

Turdus cyanotus Jardine and Selby, Illustr. Orn., i (1828 April), pl. xlvi—India, Bangalore.

Specimens obtained:—217 ♂ 13-5-29 Shevaroy Hills; 1252 ♀ 14-1-30 Godaveri Delta; 1342 (♂) marked ♀ 6-2-30, 1374 ♂ 11-2-30, 1757 ♂ 2-5-30, 1770 ♂ 4-5-30 Anantagiri 3,000 ft.; 1608 ♂ 26-3-30, 1637 ♀ 1-4-30 Sankrametta 3,500 ft.; 1733-4 ♂♂ 27-4-30 Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
7 ♂	20-24.5	109.5-112.5	73-78.5	30-31 mm.
3 ♀	22-23	103.5-107	67.5-71	28.5-29 mm.

Jerdon stated that the White-throated Ground-thrush was 'not rare' in the Eastern Ghats extending as far up as Goomsoor but this statement has been somewhat discredited, and it is of value therefore that the Survey found this race common in the hill tracts of Vizagapatam in well-wooded ravines. It was also not uncommon in suitable places in the Godaveri Delta and a single specimen was procured in the Shevaroy Hills. There are as yet no other records for the Eastern side of the Presidency.

In the West it is far better known and in our limits it is recorded commonly in Malabar, Coorg and the Brahmagherries, the lower slopes of the Nilgiris up to 4,000 ft., the Nelliampathis and the Travancore hills. In the last locality it is curious that both Bourdillon and Ferguson were under the impression that it was a winter visitor only though in the *New Fauna* it is said to breed there in May and July. In this connection it may be recalled that at its north-western limit on the Kondabhari Ghat in Khandesh Mr. James Davidson says it is a migrant, arriving in the rains to breed (N. and E., vol. ii, p. 99).

Oreocincla dauma neilgherriensis Blyth.

Oreocincla neilgherriensis Blyth, J.A.S.B., xvi (1847), p. 141—Nilgiris.

Confined to the Madras Presidency. Rare in Coorg where Betts records it as very shy and keeping to jungle with dense undergrowth and where William Davison procured a male on the Bramagherries on 20 April 1881 and a female on 15 February 1883. Jerdon's statement that he procured *O. dauma* in the Wynaad (B. of I., i, 534) doubtless refers to this form.

The best known locality for this fine Thrush is the Nilgiris where it is not uncommon in the Sholas on the higher hills.

Kinloch found it numerous in the Sholas of the Lily Downs 4,700 ft. in the Cochin Nelliampathis (J.B.N.H.S., xxix, 565). It breeds in the Palnis (Terry, S. F., x, 474). We have but little information about it in Travancore but according to Bourdillon (S. F., iv, 399) it is rather scarce and is found from the summit of the hills down to 2,000 ft.; while Ferguson (J.B.N.H.S., xv, 467) adds that though he did not personally find it below 4,000 ft. he procured it both in the High Range and the South.

It breeds in May and June and according to Rhodes Morgan starts as early as March.

Monticola cinclorhyncha (Vigors).

Petrocincla cinclorhyncha Vigors, P.Z.S. 1830-31 (2 March 1832), p. 172—Himalayas restricted to Simla-Almora area.[1]

Specimen collected:—1715 ♀ 21-4-30 Jeypore Agency 3,000 ft.

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[1] Restricted *Ibis* July 1924, pp. 468-473.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♀	23	99.5	64	24 mm.

The above specimen was fat and evidently on migration. Although nothing is known of the Blue-headed Rock-Thrush on the eastern side of the Presidency, beyond the above specimen, it is a common winter visitor from October to March to the hills of the Western side. From Coorg (common, Betts), the Wynaad, Nilgiris (very common, William Davison), and the Nelliampathies (common, Kinloch) it extends throughout the whole of the Travancore range, where Ferguson says that he has found it at 5,000 ft. in the High Range and from 500 ft. to 2,500 ft. in the south.

It has not yet been recorded from the Palnis.

Monticola solitaria pandoo (Sykes).

Petrocincla pandoo Sykes, P.Z.S. (31 July 1832), p. 87—Ghats, Deccan-Mahableshwar.

Specimens collected:—899 ♂ 10-10-29 Seshachalam Hills 2,000 ft.; 1185 ♂ 27-12-29 Cumbum Valley.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	26.5-29	122-122.5	81-83	27-29 mm.

Although the Blue-Rock-Thrush seems to be a regular winter visitor or passage migrant to the greater part of India records are scarce on the Eastern side of the Presidency. Jerdon perhaps was right when he said (B. of I. i, 513) that it was 'more rare in the Carnatic'. At any rate in addition to the above two specimens our only two east Presidency records are one seen on 9th April 1924 in a quarry at St. Thomas' Mount and another seen on 10th February 1927 in the Presidency College compound at Madras, both by Capt. R. S. P. Bates. On the west it is far better known. There it occurs in winter from October to April (and according to Bourdillon to late in May) in Coorg, the Wynaad and the Nilgiris, in the Nelliampathis, wherever sheet rock occurs (Kinloch), and in the Travancore Hills. Capt. Bates informs us that he saw one at Kodaikanal on 6 April 1929.

Myophonus coeruleus horsfieldii Vigors.

Myophonus horsfieldii Vigors, P.Z.S., 1830-31 (2 March 1831), p. 35—Himalayas, *errore*, now restricted to Nilgiris.

No specimen was obtained by the Survey but La Personne says in his field notes that he saw it in the Shevaroy Hills.

The Malabar Whistling Thrush is common in wooded country near water in all the hill ranges of the western side of the Presidency in Coorg, the Wynaad, the Nilgiris (where however it does not occur on the plateau or above 6,000 ft.), the Nelliampathis, the Palnis and the various Travancore ranges. It occurs at all elevations upwards to 5,000-6,000 ft. and Jerdon says that he killed it actually at the foot of the ghats in Malabar.

The breeding season in these areas is from March to July and in Travancore according to Stuart Baker it starts in February.

Hemichelidon ferruginea Hodgson.[1]

Hemichelidon ferruginea Hodgson, P.Z.S., August 1845, p. 32, ex Zool. Misc. 1844, p. 84—Nepal.

Although the specimen cannot be traced in the British Museum there appears to be no reason why we cannot accept Jerdon's explicit statement (B. of I., vol. i, p. 461): 'I obtained one specimen at Nellore in the Carnatic in March'

[Siphia parva parva (Bechstein).

Muscicapa parva Bechstein, Getrene Abbild. (Part II) 1793, p. 26—East Holland.

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[1] In our opinion there is considerable need of careful revision of genera in the Flycatcher group. In the account which follows we have, however, adhered to the genera given in the *New Fauna* as any revision, to be of value, must comprise all Indian and non-Indian forms.

The typical form of the Red-breasted Flycatcher passes through or winters in the whole of N.-W. and Peninsula India in those areas where the next race does not occur. Stragglers occur as far east as Sikkim and the Duars (Mandelli, Hume Collection) and Assansole (Brooks, British Museum Coll.). Southwards it is certainly fairly common as far as Belgaum and Trimulgherry, from both of which localities I have seen specimens. In the *Old Fauna* it is said to occur as far south as 'Mysore and the Nilgiris'. In the *New Fauna* this range is given as 'Malabar, Travancore and the Nilgiris'. The former statement is evidently based on Hume's remark (S.F., x, 372) 'occurs in South Mysore, at the foot of the Nilgiris', and I have seen no specimens from anywhere within our presidency limits. Betts (J.B.N.H.S., xxxiii, 544) considers it a fairly common winter migrant to Coorg. Until specimens are available for examination it appears advisable not to include this form definitely in the Presidency list.].

Siphia parva albicilla (Pallas).

Muscicapa albicilla Pallas, Zoogr. Rosso-Asiat., vol. i (1811, not published until 1827), p. 462, aves, pl. 1—Dauria.

Specimens collected:—982 ♂ imm., 7-11-29 Nallamallai range 2,000 ft.; v. 1338 ♀ 6-2-30 Anantagiri 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
♂	13	69.5	51.5	17 mm.
♀	13	67.5	49	17 mm.

As pointed out by Ticehurst (J.B.N.H.S., xxxiv, 904) it is incorrect to say that the females and young (1st winter) males of *M. p. albicilla* are not distinguishable from those of *M. p. parva*. They may be distinguished by the colder, greyer, brown of the upper parts, the truer black of the upper tail-coverts and tail and by the whiter underparts suffused with grey on the breast (instead of creamy white suffused with buff). These two specimens, combined with a careful examination of the large series of Red-breasted Flycatchers in the British Museum and in my own collection, enable me to extend the known range of this race in India.

M. p. albicilla is, as always stated, mainly confined to N.-E. India as a winter visitor in Bengal, Bihar and Orissa. Stragglers however occur along the base of the Himalayas as at Basti (♀ 25-10-1869 Brooks, Hume Coll.), Pilibhit (♂ 1st. win., 16-10-78 Cleveland, Hume Coll.) and Kangra where a bird obtained by me and recorded as *S. p. hyperythra* (♂ 1st. win. 3-2-23 Bharwana 2,500 ft., Ibis 1926, 563) proves on further investigation to belong to this form. Southward of Orissa this form probably straggles across the Deccan generally as I have examined specimens from Badrachalam (Blanford), Satara (Fairbank), Dahivel, Khandesh (Davidson) and Belgaum (Butler). The above Nallamalai specimens provide the most southerly record.

In this connection we may remark that in our opinion it is quite wrong to consider the Kashmir Red-breasted Flycatcher a race of *Muscicapa parva*. It is evidently a separate species, more closely allied to the *Muscicapa strophiata* group. From the *parva* group it differs not merely in the character of the brown of the upper parts and of the red of the breast with its peculiar black border, but also in the sequence of plumages and the wing formula.

The young male in its first winter resembles not the female, as in *parva* and its race, but the adult male, and the female agrees with this stage of development in having much red wash on the breast. The Second primary is almost always shorter than the seventh, where as in *parva* it is always longer than the seventh, generally considerably so.

Muscicapula superciliaris Jerdon (Subsp?).

Muscicapa superciliaris Jerdon, Madr. Jour. Lit. Sci., vol. xi, (1840, after May) p. 16—N. Indian Ghats, Ajunta.[1]

Specimen collected:—1657 ♀ 4-4-30 Sankrametta 3,500 ft.

Measurements—

Bill.	Wing.	Tail.	Tarsus.
13	64	44-5	16 mm.

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[1] See Jerdon, *Birds of India*, vol. i, p. 471.

This specimen, which was very fat with the organs undeveloped, was evidently on migration and provides the only record of this Blue Flycatcher within the Presidency. Unfortunately it is a female and as it comes near from the border line of the winter distribution of both races and is intermediate in colour we are unable to say positively whether it is *C. s. superciliaris* or *C. s. astigma.*

The adult males of *C. s. astigma* are easily separable from the typical race by the absence of the white patches in the base of the outer tail feathers, by the absence or very faint traces of the white supercilium, and by the having the upper parts a darker blue on the average. First year males are also easily separable by the absence of the white tail patches.

Some females may be distinguished as follows. In *astigma* the upper parts tend to be a darker more saturated brown with but little and often no hint of blue in it; the rump and edges of the base of the tail are often rufous.

In *superciliaris* the upper parts tend to be of a paler and greyer tint, with often a suspicion of blue in it. The rump and edges of the base of the tail are often definitely blue. There is however a good deal of intergrading, so that single winter specimens cannot be distinguished with certainty.

Muscicapula pallipes pallipes Jerdon.

Muscicapa pallipes Jerdon, Madr. Jour. Lit. Sci., vol. xi (1840 after May), p. 15—Coonoor Ghat.

Not met by the Survey. This Flycatcher is entirely confined[1] to the western side of India where it is a bird of thick forest or shady cover on the various ranges. Its northern limit appears to be about the Goa Frontier (S.F., iv, 257 and ix, 397). In the Madras Presidency it is recorded as fairly common in Coorg, the Wynaad and the Nilgiris. Although Ferguson states that he never met with the species in Travancore there is a juvenile specimen (labelled *Alseonax muttui*) in the British Museum collected by him in September 1893 on Chimungi. Bourdillon however considered it as 'not rare though nowhere common' from 1,000 ft. upwards and Mr. Stewart has since met with it in numbers.

According to the *New Fauna* the breeding season is usually from March to April, but Mr. Stewart has taken nests from February to September.

Muscicapula rubeculoides rubeculoides (Vigors).

Phœnicura rubeculoides Vigors, P.Z.S. 1830-31 (March 2, 1831), p. 35—Himalayas, restricted to Simla—Almora area.[2]

Specimens collected:—983 ♀ 8-11-29 Nallamallai range 2,000 ft.; 1643 ♂ ad. 2-4-30 Sankrametta 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus
♂	14	73.5	56.5	16 mm.
♀	13.5	71.5	53	16.5 mm.

As a winter visitor the distribution of the Blue-throated Flycatcher is much wider in India than the account given in the *New Fauna* would lead one to understand. It was more correctly given in the first edition.

There are several records for the Presidency in addition to the above Survey specimens. The three specimens marked 'Madras' in the British Museum need not detain us, as there is nothing to show where they were obtained (♂ April 1876 ♀ no date, both Hume collection, ♂ no date Baber), though the name Baber doubtless stands for H. H. Baker in which case the bird may have come from Malabar. Jerdon (B. of I., i, 466) says that it is 'rare in the south of India but I have procured it both on the east and western coast'. We know from Madr. Journ. Lit. Sci. 1844, p. 171 that by the western coast he means 'the Coonoor Ghat'. William Davison (S.F., x, 370) says that he obtained two males in February and March—one at Seegore, the other at Nellacotta in the Wynaad. It has also been obtained in Ceylon.

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[1] The record of 2 females at Hylakandy (J.B.N.H.S., xiii, 655) is evidently based on faulty identification.

[2] Restricted Ticehurst and Whistler, Ibis 1924, p. 468.

Muscicapula tickelliae tickelliae (Blyth.)

Cyornis tickelliæ Blyth, J.A.S.B., xii (1843 after November), p. 941—Borabhum in Maunbhum.

Specimens collected:—22-23 ♀♂ 11-4-29, 115 ♂ 23-4-29, 149 ♀ 28-4-29, 170 ♂ 2-5-29 Kurumbapatti; 205 ♂ 11-5-29, 228 ♂ 15-5-29 Shevaroy Hills 3,500 ft.; 365 ♂ 8-5-29, 393 ♂ 12-6-29, 397 ♂ 13-6-29, 427 ♀ 16-6-29 Chitteri range 2,000-3,000 ft.; 631 ♂ 1-8-29, 655 ♂ 6-8-29, 662 ♂ 7-8-29, 727 ♀ 22-8-29 Palkonda Hills 1,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
11 ♂	14-16.5	71-75	56-62	16.5-18.5 mm.
4 ♀	13-15	68-70	54-57	15-17 mm.

In spite of its wide distribution in India and the fact that, except for short local migrations in some areas, it is a resident species, Tickell's Blue Flycatcher has apparently no subspecies within India proper.

There appears to be some mistake about the description of the juvenile in the *New Fauna*, where it is described as a definitely brown and fulvous bird. The only juvenile which we have been able to examine is remarkable for the bright blue wings and tail and the dark bluish tinge to the upper parts. The point is of interest as this Flycatcher with its blue male and female and bluish young would appear to be one of the members of the genus in which the characteristic blue has reached its most complete stage of development. It would be interesting to prepare an exhibit of this group showing the gradual transition to this complete blue development from *poliogenys poliogenys* with male, female and juvenile all brown.

Within the Presidency limits Tickell's Blue Flycatcher appears to be fairly widely spread and not uncommon. The survey did not procure it north of the Palkonda Hills but Jerdon informs us that it occurs in Goomsoor and the Northern Sircars and the fact that Blanford met it just outside our boundary in the Godavery valley near Dumagudiam and Badrachalam suggests that it may occur throughout the north-east of the Presidency.

In the Palkonda Hills La Personne states that it was common in the bamboo forests at Ballipalle at 1,000 ft. A specimen from 'Madras' (F. Nicholson) is in the British Museum but Dewar states that he never saw the species at Madras Town though a live bird was brought to him which was said to have been captured some five miles inland. In Salem district the survey found it 'practically all over the well wooded parts of the district and it is more common in the hill tracts at 3,000-4,000 ft.' Here the birds were evidently breeding in May and June. This is the most southerly record on the eastern side and in Travancore curiously enough the bird does not seem to have been recorded though we have seen a male in Colonel Sparrow's collection which he obtained at Kumilli, Cardamum Hills on 1st April, 1914.

In the Palnis it is recorded as noted 'unfrequently from top to bottom' by Fairbank, and Terry found it breeding in the Pittur valley. There is no record for the Nelliampathis. In the north west corner of the Presidency it seems to be fairly general both in hills and plains. There are 3 specimens from 'Malabar' and one from Calicut in the British Museum. In the Nilgiris it is fairly common on the slopes as high as Coonoor and Davison obtained a male close to Ootacamund on 10th February 1881. Thence it extends through the Wynaad and into Coorg.

Muscicapula poliogenys vernayi (Whistler).

Cyornis poliogenys vernayi Whistler, Bull. B.O.C., vol. lii, No. ccclii, p. 23—Sankrametta 3,500 ft., Vizagapatam District.

Specimens collected:—1337 ♂ (ad.) 6-2-30, 1422 ♂ (ad.) 21-2-30, 1449 ♂ (imm.) 26-2-30 Anantagiri 3,000 ft.; 1467 ♂ (ad.) 3-3-30, 1486 ♂ (ad.) 6-3-30 1527 ♂ (ad.) 12-3-30, 1545-7 ♂ (ad.) ♀♀ 15-3-30, 1593 ♂ (imm.) 24-3-30 1630 ♂ (imm.) 31-3-30, 1650 ♀ 3-4-30, 1664 ♂ (imm.) 5-4-30, 1671 ♂ 12-4-30 1676 ♂ 12-4-30 Sankrametta 3,000-3,500 ft.; 1753 ♀ 2-5-30 Anantagiri 300 ft.

Measurements—

	Bill.	Tail.	Wing.	Tarsus.
6 adult ♂:	15-16.5	75.5-78.5	60.5-67.5	18-20 mm.
6 immature ♂:	14.5-15.5	74.5-78	59-64	18-20 mm.
4 ♀	14-15.5	70.5-74	57.5-60	18-19 mm.

'Very common at Sankrametta and Anantagiri where these birds were breeding in April and May' (La Personne).

This new form of resident flycatcher of very limited distribution is one of the most interesting discoveries of the Vernay Survey.

The females and first year males are identical in colouration. They closely resemble *Muscicapula poliogenys poliogenys* (Brooks), differing only in the greyer tint of the upper parts, which is particularly marked on the crown and nape and sides of the head and neck. The adult male is distinguished by a bluish wash over the whole of the upper parts. This is pronounced on the head and nape and becomes a definite bright blue on the longer upper tail-coverts and outer webs of the tail-feathers. The males breed in both stages of plumage.

This new Flycatcher throws considerable light on the question of generic distinctions in the Muscicapidæ. The genus *Anthipes*, founded by 1847 by Blyth, with *Anthipes moniliger* for type, was used by Oates in vol. ii of the *Old Fauna* to include five species (*A. moniliger*, *A. leucops*, *A. submoniliger*, *A. poliogenys* and *A. olivaceus*) of very local non-migratory Indo-Malayan Flycatchers in which the sexes are alike. This was in contradistinction to the genus *Cyornis* of which he assigned as a characteristic the different colouration of the sexes.

In vol. ii of the *New Fauna* Mr. Stuart Baker accepted this conception of the genus *Anthipes* with five forms though he changed the grouping to two species with, respectively, three and two subspecies. At the same time he pointed out that the two species thus admitted were so different in habits, nidification and colour pattern that they might almost be placed in separate genera. By vol. viii (p. 631) his opinion on this point had strengthened to the creation of a new genus *Olcyornis* (type *Anthipes olivaceus* Hume) to mark the separation of *A. olivaceus*, with its subspecies *A. o. poliogenys*, from *A. moniliger* with its subspecies *A. m. leucops* and *A. m. submoniliger*. In the meantime Messrs. Kinnear and Robinson (Nov. Zool., xxxiv, 1928, p. 241) had emphasised the same distinction by placing *poliogenys* in the genus *Cyornis*, together with a new race *saturatior*. They, however, considered *olivaceus* and *poliogenys* as specifically and possibly generically distinct.

Our new form *vernayi* by its colouration connects *poliogenys*, with both sexes alike and brown, and the other members of the genus *Muscicapula* (*Cyornis*) in which the females are brown, and black or blue predominates in the plumage of the males. It therefore justifies Brook's original description of *poliogenys* in the genus *Cyornis* and corroborates Mr. Stuart Baker's objection to keeping *olivaceus* and *poliogenys* in the same genus as *moniliger* though his creation of the new genus *Olcyornis* was unnecessary. The widening of the genus *Cyornis* to include a species in which both sexes may be alike and brown, however, invalidates its basis on sexual dimorphism and provides another of the many reasons for the revision of genera in this family.

Eumyias albicaudata (Jerdon).

Muscicapa albicaudata Jerdon, Madr. Jour. Lit. Sci., xi (1840 after May), p. 16—Nilgiris.

Not observed by the Survey. The Nilgiri Flycatcher is peculiar to the south-west hill ranges of the Presidency and is very common in the Nilgiris, Nelliampathis, the Palnis and the Travancore Hills. It is a bird of the higher elevations being mostly found from 4,000 ft. to the summits in woods and thickets, but Davison records that in the Nilgiris he found it locally in smaller numbers below 4,000 ft. on the slopes. Mr. Stuart Baker says (vol. ii, p. 243) that he has also records of its occurrence in the Wynaad, Palghat and Southern Malabar. It is of course a permanent resident and breeds from March until May, but occasionally a nest may be found in February and June.

[Ferguson (J.B.N.H.S., xii, 202) erroneously recorded *Eumyias sordida*, the Dusky Blue Flycatcher of Ceylon, as occurring in Travancore. He later corrected the statement (*loc. cit.*, xv, 464.)].

Eumyias thalassina thalassina (Swainson).

Muscicapa thalassina Swainson, Nat. Libr. Flycatchers, 1838, p. 252—India.

Specimens collected:—974 ♂ 6-11-29 Nallamallai range 2,000 ft.; 1322 ♂ 5-2-30, 1373 ♂ 11-2-30 Anantagiri 3,000 ft.; 1461 ♀ 2-3-30, 1633 ♀ 31-3-30 Sankrametta 3,000 to 3,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	13.5-14	82-86	68-75	15.5-16 mm.
2 ♀	13-13.5	82-84	64-68.5	16-17 mm.

There are not many records of the Verditer Flycatcher in the Presidency where it is, of course, a winter visitor only. Jerdon procured it at Gumsoor. La Personne found it common at Anantagiri and Sankrametta. The above specimen from the Nallamallais completes the records which we can trace on the eastern side.

On the west we have seen specimens from Calicut (two birds, no date, Hume collection), Wynaad (♀ 8-1-94 J. P. Cook B.N.H.S. Coll.) and Kotagherry (♀ 26-11-74 Cockburn, Hume collection). William Davidson in his paper on this area remarks that he never met the bird in Southern India.

In the Nelliampathis Kinloch states that he found the Verditer Flycatcher very common during the cold weather. Bourdillon also says that in the Travancore Hills it is a common though not abundant winter visitor up to 2,000 ft. from December to March. Ferguson on the other hand curiously enough did not meet with it and was inclined to doubt Bourdillon's record. It is however supported by 3 specimens still in the British Museum.

The *New Fauna* suggests that the Verditer Flycatcher may sometimes breed in the hills of Southern India in view of the fact that Kinloch met with it in the Nelliampathis until March. Mr. Stuart Baker seems, however, to have overlooked Kinloch's postscript (J.B.N.H.S., xxviii, 279) in which he clearly says that he did not see the birds after the end of March. La Personne also thought that it might be breeding in the Vizagapatam Hills as the specimens collected shewed genital development. It must be remembered, however, that this species is an early migrant to return to the Himalayas and quick to breed as soon as it returns. The organs, therefore, start to enlarge, as in several other species, before the migration. There is no reason at all to suppose that it ever breeds in the southern ranges, where the last species takes its place.

Alseonax latirostris (Raffles).[1]

Muscicapa latirostris Raffles, Trans. Linn. Soc., xiii (1822), p. 312—Sumatra.

Specimens collected:—304 ♀ 1-6-29, 333 ♂ 5-6-29 Chitteri range 2,000 ft.; 830 ♂ 18-9-29 Kodur; 857 ? 1-10-29 873 ♀ 4-10-29, 886 ♂ 7-10-29, 898 ♂ 10-10-29 Seschachalam Hills 2,000 ft.; 952 ♂ 1-11-29, 97 ♂ 5-11-29 Nallamallai range 2,000 ft.; 1680 ♂ 13-4-30 Sankrametta 3,500 ft.; 1684 ♂ 16-4-30 Jeypore Agency 3,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
8 ♂	14-15.5	70-75	46.5-54	13-14.5 mm.
2 ♀	14-15	73	50.5-51.5	13.5-14 mm.

The Brown Flycatcher appears to be very generally distributed throughout the Madras Presidency though its status is not very satisfactorily known. The above series of specimens afford the only records for the eastern side of the Presidency except for Dewar's statement that the species is by no means common at Madras, where he only noticed it in winter. One may perhaps presume that the June birds from the Chitteri range were in their breeding quarters, but the male shot at Kodur in September was very fat and therefore probably on migration.

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[1] While we are not prepared at present to undertake a revision of the genera of the Flycatchers, which appears necessary, we see no reason why this species should be removed from the genus *Muscicapa*, in which indeed it is included by the Nomenclature Committee of the British Ornithologists' Union.

In the west of the Presidency the Brown Flycatcher is well known. A female collected by Day at Mangalore on 24 April is in the British Museum. In Coorg, according to Betts, it is fairly common and resident, and there are two undated specimens from that district in the Tweeddale collection. William Davison says that it is not uncommon in the Wynaad and that he met it on two or three occasions on the slopes of the Nilgiris. He considered it a winter visitor and he does not appear to have met it after April 11th. Kinloch records it from the Nelliampathis without comment. Fairbank and Terry each met it once in the Palnis (no date). In Travancore it seems to be common as a winter visitor found occasionally in the low country but more generally from the foot of the hills up to about 3,000 ft. A few are said to breed in Travancore but the evidence on the point is not entirely satisfactory.

After examining a very great number of specimens of this species from the different parts of its wide range we are not satisfied that it has any races. Mr. Stuart Baker (*New Fauna*, ii, p. 249) considers that the typical race is confined to Borneo, Sumatra, the Malay Peninsula, Burma, Siam and Annam and possibly Yunnan and Western China but we have failed to find any evidence that the species breeds in these countries and we are under the impression that it only occurs in them as a migrant. Of the other race *poonensis* he gives the range as from Japan to Lake Baikal and again in the Himalayas and India. He measures birds from Japan to Himalayas wing 69 to 80 mm., and from the plains of India as 66 to 72 mm. This difference we cannot substantiate as the following measurements of males will show:—

	Bill.	Wing.	Tail.
6 ♂ Tenasserim, Malays	14	67-71.5	46-48 mm.
4 ♂ Amur Bay, E. Siberia	14	68.5-71	45-48 mm.
5 ♂ Japan	13.5-14	69.5-72.5	46-48.5 mm.
8 ♂ E. Ghats Survey	14-15.5	70-75	49-54 mm.
7 ♂ Western India	14-15	70-74.5	48.5-52 mm.
10 ♂ Western Himalayas	14.5-16	68-75.5	49-54.5 mm.

There is no appreciable difference of measurements here other than that explainable by the comparative number of specimens available for measurement. The colour and other differences of two supposed races were described at length by Brooks (S.F., ix, p. 225) and Hume under the same reference explained that they were partly seasonal and perhaps partly individual, and to this conclusion we have ourselves independently arrived. Normally this Flycatcher is greyish in fresh plumage and abrades to brown but individuals in any stage may be grey, brown and even fulvous, in general tint.

Alseonax ruficauda (Swainson).

Muscicapa ruficauda Swains, Nat. Lit., vol. x (1838), p. 251—India, restricted to Kashmir.[1]

Not met by the Survey. The Rufous-tailed Flycatcher is only an uncommon winter visitor to the Presidency. Jerdon obtained a specimen (no date) at Nellore. William Davison collected a male at Charambady, Wynaad, on 2-4-81 and another male at Coonoor on 25-1-81, while Miss Cockburn collected a specimen at Kotagherry on 14-3-71. These specimens are all in the British Museum as well as four others obtained in Travancore as follows: 3 unsexed birds collected at Mynall by Bourdillon 27-11-74 and 4-12-78 and no date respectively, and a female collected by Ferguson at Panmudi in December 1890.

Alseonax muttui muttui (Layard).

Butalis muttui Layard, Ann. Mag. Nat. Hist. Sci. 2, vol. xiii (Feb. 1854), p. 127—Pt. Pedro, Ceylon.

Not met by the Survey. There are eight records of Layard's Flycatcher within the Presidency, all but one based on specimens from Travancore in the British Museum. Three of these were collected by Bourdillon at Mynall, namely a male on 18-11-74, a supposed female on 14-1-76 and an unsexed bird without date. The fourth is a female, dated 29-12-85 one of 4 specimens collected by William Davison at Chimpazi on the Chimpani Hills which divide Travancore from Tinnevelly (Ibis 1886, p. 146). Ferguson records (J.B.N.H.S., xv, 464) that he also obtained a single specimen in Travancore but we have failed to trace particulars of this bird unless it is the juvenile referred to below. A specimen collected by J. P. Cook at Pelchola in the Wynaad on 6-1-1894 is in the collection of the Bombay Natural History Society.

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[1] Stuart Baker, J.B.N.H.S., xxvii, p. 79.

In the *New Fauna* it is suggested that this Flycatcher may breed in the high hills of its supposed winter quarters in Travancore. We do not think so. The specimens obtained by Brooks at Muddapur on 25 September (S.F., vii, 456), by James Davidson at Bhatkal, Kanara, on 20 January 1889 (J.B.N.H.S., xi, p. 668) and by Currie at Bolarum, Secunderabad, on 2 October 1917 (J.B.N.H.S., xxvi, p. 667) show that the bird travels southwards in winter whilst the juvenile specimen collected at Chimunji in September 1893 and attributed to this species in the British Museum appears to us to be really a specimen of *Cyornis pallipes pallipes*. Layard's original specimen is said to have been obtained in Ceylon in June. Legge however clearly states that the bird is a North-east Monsoon visitor in January and February to the island. This bird affords one of the many instances of the generic confusion of the Flycatchers. Placed by the *Fauna* in the genus *Alseonax* it might almost pass as a longbilled pale race of *ferruginea* placed in the genus *Hemichelidon*.

Ochromela nigrorufa (Jerdon).

Saxicola nigrorufa Jerdon, Madr. Jour. Lit. Sci., vol. x (December 1839), p. 266—Nilgiris.

This striking bird is confined to the hill ranges of the Western side of the Presidency and was not observed by the Survey. In the Wynaad, according to William Davison, it is rare. In the Nilgiris it is common both on the summit and on the slopes down to 5,000 ft., occurring below that only as a straggler. In the Palnis it is the commonest of the Flycatchers at higher elevations. In Travancore Bourdillon says that it is scarce not found from 2,500 ft. upwards. Ferguson however calls it common on the High Range and also from 3,500 ft. to 4,000 ft. in the Southern hills.

The breeding season is from March to May and a few eggs may still be found in June.

The juvenile plumage of the Black and Orange Flycatcher is not known except from a somewhat sketchy 'sight' record by Dewar (J.B.N.H.S., xvi, 154). It is important to verify this as the appearance of the bird and its aberrant breeding habits suggest that it may really belong to the *Timaliidæ.*

Culicicapa ceylonensis ceylonensis (Swainson).

Platyrhynchus seylonensis Swains, Zool. Illusfl, vol. i (1820, Dec.), pl. 13—Ceylon.

This resident race of the Grey-headed Flycatcher is well-known in the hill ranges of the west of the Presidency where it breeds from March till May, most nests being found in April.

In the Wynaad Mr. Darling Junr. says it is common down to probably about 3,500 ft., but he gives 4,500 ft. as its lowest elevation in the Nilgiris, where it is common up to the highest summits. It is common throughout the Nelliampathis, the Palnis, the High range of Travancore and on the tops of all the Assambo ranges.

Culicicapa ceylonensis pallidior Ticehurst.

Culicicapa ceylonensis pallidior Ticehurst, Bull. B.O.C., xlvii (1927), p. 108—Simla.

Specimens obtained:—1510 ♀, 1511 A ♂ 10-3-30, 1455 ♂ 2-3-30 Sankrametta 3,800 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	12-12.5	66-67	55-57	13-13.5 mm.
1 ♀	12	60	52.5	13 mm.

'Not common at Anantagiri but quite common at Sankrametta in the wooded ravines' (La Personne). It is with some hesitation that we refer these three specimens to the northern breeding race as in colouration they seem somewhat intermediate, the upper parts matching the typical race and the lower parts *pallidior*. As the collector however failed to sex 2 out of the 3 specimens by dissection, it appears probable that the birds were on migration and on their way to the Himalayas. It is of course possible that the Grey-headed Flycatcher breeds in the Vizagapatam ghats and if so this would explain the intermediate colouration. We can trace no other record of this species in the eastern side of the Presidency.

Tchitrea paradisi paradisi (L.)

Corvus paradisi Linn., Syst. Nat., ed. x (1758), p. 107—Fort St. George, Madras.

Specimens collected:—30, 36 ♂♂ 12-4-29, 60 ♀ 15-4-29, 125 ♂ 25-14-29 Kurumbapatti; 642 ♂ 2-8-29, 676 ♂ 12-8-29 Palkonda Hills 1,000 ft.; 869 ♂ 3-10-29 Seshachalam Hills 2,000 ft.; 166, ♂ 5-4-30 Sankrametta 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂ with streamers	23.5-27	93-98.5	112-119	17-17.5 mm.
3 ♂ (♀ plumage)	24-25.5	87.5-89	94.5-106	17-18 mm.
2 ♀	23-23.5	85.5-92	86-104	16.5-17.5 mm.

There is really surprisingly little on record about the Paradise Flycatcher in the Presidency though it is presumably much commoner than our information would lead us to suppose. La Personne reports that he found it widely distributed, though not common, in April in the Vizagapatam Hills. Southwards we have no definite information until the Seschachalam Hills and Palkonda Hills where the above specimens were obtained. The bird breeds at Horsleykonda in May (Roscoe Allen, J.B.N.H.S., xviii). It occurs about Madras City (at all seasons according to Dewar) and there Dr. Buckley obtained the type in the eighteenth century. In Salem District the Survey found it not uncommon in the Shevaroys and about Kurumbapatti and others were seen in the Chitteri range at 3,000 ft. and at Tirthamalai. There is nothing to show whether the survey birds were in their breeding range or on migration. From the western side there are specimens in the British Museum from Cannanore (7-6-1882 Wardlaw-Ramsay) and Calicut (2-12-81, 1-1-83 Wardlaw-Ramsay), and two undated specimens from the Hume collection). In Coorg, according to Betts, it is resident but not common. Specimens from Manantoddy 10 April 1881 and Sultan's Battery, Wynaad 4 April 1881 (W. Davison) are in the British Museum. In the Nilgiris according to William Davison it occurs up to 6,000-8,000 ft. though it is locally distributed and nowhere very common.[1]

In the Nelliampathis, according to Kinloch, the white males are most abundant. Terry met with a single bird at Pulungi in the Palnis.

In Travancore, the Paradise Flycatcher is very common in the low country jungles but only ascends the hills during the hot weather of February and March (Bourdillon). Ferguson confirms his account and adds that he has shot it up to 6,000 ft. in the High Range and up to the Summits of the hills in the south.

As the type-locality of the typical form is Fort St. George,[2] Madras, no particular difficulty was attached to the identification of the Survey specimens. We however took this opportunity of examining the whole question of the races of the Paradise Flycatcher within the limits of the Fauna as we have long felt that the treatment of the species in the *New Fauna* was unsatisfactory. As a result we find ourselves compelled to modify that treatment very considerably.

The first essential in any consideration of the Paradise Flycatcher is to realise that all or most of its races are truly migratory, a point which is not sufficiently recognised in the *New Fauna* though Mr. Briggs has suggested it in some detail in J.B.N.H.S., xxxv, pp. 675-679. We therefore as a preliminary set ourselves to establish the characteristics of the breeding birds of India so as to avoid the errors attendant on the fact that more than one race may occur in any given area. A further difficulty lies in the fact that the plumage stages are not yet known and we have not yet succeeded in unravelling them. Here the difficulty lies in the unreliable sexing of many specimens in collections, the absence of sufficient moulting intermediates, the fact that numerous statements of what people have *seen* is often not confirmed by any *specimens* which we have been able to examine, and finally the fact that it is unreliable to assume that the changes are necessarily parallel in each race. They certainly are not in each species of this widely spread genus and the presumption is that the evolutionary stages represented in the various species are likely to be reflected in some subspecies.

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[1] The only specimens we have examined from the Nilgiris prove to be winter specimens of *T. p. leucogaster*.

[2] See Ticehurst, J.B.N.H.S., xxxi, p. 495 and ourselves *loc. cit.*, xxxiv, p. 396. It was unnecessary for Mr. Stuart Baker (vol. ii, p. 266) to restrict the type locality.

As a result of our enquiry we recognise the existence of three well defined races within our area. Birds from Ceylon are commonly attributed to the typical race but we should not be surprised to find that a carefully collected series of local breeding birds, for migrants evidently visit the island, would reveal the existence of an insular breeding race, a characteristic of which may be a partial elimination of the white phase. That however does not affect the recognition of the following races.

Tchitrea paradisi paradisi (L.)

Corvus paradisi Linn., Syst. Nat., ed. x (1758), p. 107—Fort St. George, Madras.

Peninsula India, but northern boundaries not established for lack of specimens. Apparently migrates southwards to Ceylon and eastwards to Burma.

Tchitrea paradisi leucogaster (Swainson).

Muscipeta leucogaster Swainson, Nat. Library, Flycatchers (June 1838), p. 205—India.[1]

Differs from typical race as follows:—

(i) *White ♂ with streamers*: Not distinguishable but tends to have narrower bill and shorter tail and streamers.

(ii) *Red ♂ with streamers*: (*a*) The chestnut is distinctly paler in tint.
(*b*) In about 80 per cent the white of the lower parts extends straight up to the black of the throat without any intermediate ashy grey area on the breast.
(*c*) Wings largely but irregularly variegated with white in the primaries and secondaries.

(iii) *♀ and immature ♂*: (*a*) Chestnut of upper plumage is distinctly paler.
(*b*) The dark portions of the vanes of the primaries and secondaries is usually far more extensive and the Tertiaries have usually a dark shaft streak.

Extralimital and also breeding as a summer visitor through parts of N.-W. India and the Western Himalayas to Nepal, migrates in a southerly direction to the west coast of India and also perhaps in an easterly direction to Burma.

Tchitrea paradisi nicobarica (Oates).

Terpsiphone nicobarica Oates, Fauna Brit. India, Birds, vol. ii, (1890—Oct.) p. 48—Nicobars.

(i) *White ♂ with streamers* differs from *paradisi* and *leucogaster*:—
(*a*) Shorter crest.
(*b*) Slight increase of black streaking on the upper parts.
(*c*) More black edging on the tail-feathers.

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[1] This was one of the Countess of Dalhousie's birds and therefore probably came from Simla (vide Ibis 1929, 131).

(ii) *Red ♂ with streamers* differs from *paradisi*:—

- (*a*) Head, neck and breast are dark ashy grey, the glossy black confined to a cap and short crest.
- (*b*) Upper parts paler chestnut, washed on the mantle with ashy olive.
- (*c*) Wings dark brown, only edged with chestnut.
- (*d*) Flanks and under tail-coverts washed with pale fulvous chestnut.
- (*e*) Shortness of streamers.

(iii) ♀ *and immature* ♂ differ from *paradisi* correspondingly in the relevant details.

In (ii) and (iii) the differences from *leucogaster* are equally striking but the colouration of the head is immediately sufficient for separation. It is also smaller than both the other Sikkim races. Duars and Upper Assam migrating southwards through Burma to Andamans and Nicobars.

NOTE.—We cannot understand how this very distinct race occurring in Sikkim and Upper Assam is attributed by Stuart Baker (*New Fauna*, ii, p. 268) to *leucogaster*. Oates had already (*Old Fauna*, ii, p. 47) considered the differences from Indian birds so great that he included them in a separate species *affinis*, though in creating a third species *nicobarica* he had overlooked the fact that Hume had already pointed out (S.F., ii, p. 216) that Andaman and Nicobar birds are absolutely identical with Sikkim birds. Under the binomial system he was justified in using the name *affinis*[1] but subspecifically our birds undoubtedly differ from the tone *affinis* of *Malacca*. For instance in the red males with streamers, *nicobarica* differs from *affinis* in (*a*) the paler chestnut of the upper parts, (*b*) the olive ashy wash on the mantle, (*c*) the paler ashy grey of the head, throat and breast and (*d*) the shorter streamers.

There can be no confusion in this stage between *affinis* and *paradisi* as the short crest and the restricted black cap of *affinis* at once prevent the possibility of any mistake.

Table of Measurements.

White ♂ with streamers.

	Bill.	Wing.	True Tail.	Streamers.	Tarsus.
paradisi (13 specimens)	23.5-27	90-98.5	104.5-146	290-412	16.5-17.5 mm.
leucogaster (9 specimens)	23.5-26	92-101	104-125.5	316-402	16-16.5 mm.
nicobarica (17 specimens)	20-24	88-96	92-108	140-358	14.5-16 mm.

Red ♂ with streamers.

(Note that in this phase streamers tend to run shorter than in the whiter phase.)

paradisi (16 specimens)	22-26.5	92-99.5	100-118	299-405	16-18
leucogaster (9 specimens)	24-26.5	93-100	104.5-116.5	267-332	16.5-18.5
nicobarica (4 specimens)	22-25	88.5-94.5	92.5-102	165-233	...

Females.

paradisi (6 specimens)	22.5-24	85.5-92	86-110	...	16-17.5
leucogaster (8 specimens)	22-24	82.5-92	89-106.5	...	15.5-17.5

Reliably sexed females, as opposed to immature males, are not easy to find for examination.

Tchitrea paradisi leucogaster (Swainson).

There are six specimens of the Paradise Flycatcher from the Presidency in the British Museum which we have no hesitation in assigning to this race, which will probably prove to be a regular winter visitor to south-west India and Ceylon. They are as follows:—Immature ♂ 9-4-81 Manantoddy, ♀ 1872 Goodalore, Wynaad (William Davison); 2 white ♂♂ with streamers 22-10-74 and 10-3-81 and a red ♂ with streamers 1-12-74 Kotagherry (Miss Cockburn); ♀ April, 78 Kullar (Wardlaw-Ramsay).

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[1] *Tchitrea affinis* Blyth, J.A.S.B., vol. xv (1846), p. 292—Malacca.

Hypothymis azurea styani (Hartlaub).

Siphia styani Hartlaub, Abh. Nat. Ver. Bremen, vol. xvi (2), (1898), p. 248—Hoihow, Hainan.

Specimens collected:—55 ♂ 15-4-29, 66 ♀ 16-4-29, ♂ 20-4-29, 121 ♀ 24-4-29, 163 ♂ 1-5-29 Kurumbapatti; 285-6 ♂ ♀ 29-5-29 Chitteri range 2,000 ft.; 728 ♂ 22-8-29 Palkonda Hills 1,000 ft.; 988 ♂ 9-11-29, 1,005 juv. 13-11-29 Nallamallai range 2,000 ft.; 1382 ♀ 13-2-30, 1440 ♀ 25-2-30, 1448 ♂ 26-2-30, Anantagiri 3,000 ft.; 1607 ♂ 26-3-30 Sankrametta 3,000 ft.; 1749 ♂ 30-4-30 Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
7 ♂ adult	14-15.5	69.5-74	69.5-76.5	15-16.5 mm.
3 ♂ imm.	14.5-15.5	68-71.5	67-72	15.5-16 mm.
5 ♀ ...	14.5-15	66-69	65-70	15-16.5 mm.

As already pointed out by Dr. Ticehurst (J.B.N.H.S., xxxi, p. 495), the distribution attributed to the Black-naped Flycatcher in India by the *New Fauna* is far too sweeping. Except for a single straggler obtained at Karachi (Ibis 1922, p. 626) we can trace no record north-west of a line from Dhulia, Sehore and Lucknow, i.e. in quite half of northern India. We are also unable to recognise two races of this Flycatcher within Indian limits. In north and south there is certainly no difference between the females. The males are stated to differ in the richness and brightness of the upper parts, and in the extent of the blue on the lower parts. This we can certainly not uphold on the material available. There are only 5 adult males from Northern India in the British Museum, all collected by King Robinson in the Darjeeling area. These Darjeeling skins are not well filled out, so that the feathers sit more closely, show nothing of their bases and so seem a more uniform blue. Allowing for this fact we cannot see that they differ either from our survey series or from a considerable number of South Indian skins examined. The apparent extent of blue on the lower parts is evidently also a question of make-up of skin.

All these Indian birds are very close to the typical race. There is no difference in the colour of the males, but our Indian birds are on a series slightly larger and the females are a paler, less rich colour throughout. They agree with *H. a. styani* and may be accepted as belonging to that race. The Ceylon bird is of course easily separable.

No mention is made in the *Fauna* of the fact that the first winter plumage of the male is exactly similar to that of the adult female.

The distribution of the Back-naped Flycatcher in the Presidency is not very fully known, though it appears to be largely a hill bird. In the Vizagapatam ghats La Personne reports that it is scattered over a wide area and ascends to 4,000 ft. It was found in the Nallamallais and Palkonda Hills and in Salem District it was reported as uncommon at Kurumbapatti but much commoner higher up in the Shevaroys and Chitteri range. Mr. Howard Campbell found it breeding at Gooty.

On the western side Betts found it scarce in Coorg where he only observed it once or twice. In the Wynaad and the Nilgiris it is common though it does not quite ascend to the plateau. It is not recorded in the Nelliampathis or Palnis but in Travancore is spoken of by both Bourdillon and Ferguson as fairly common in the hills.

In the Gooty area Mr. Howard Campbell took eggs as early as April and La Personne found a nest in the Shevaroys on May 17th. In the Nilgiris the usual breeding season seems to be about June but William Davison found a nest with newly hatched young on August 28.

Leucocirca aureola compressirostris Blyth.

Leucocerca compressirostris Blyth, J.A.S.B., xviii (1849), p. 815—Ceylon.

Specimens collected:—450 ♀ 19-6-29, Harur 1,000 ft.; 554 ♀ 18-7-29, Gingee; 659 ♀ 6-8-29, Palkonda Hills 1,000 ft.; 895 ♀ 8-10-29, Seshachalam Hills 2,000 ft.; 1041 ♂ 28-11-29, Nallamallai range 2,000 ft.; V. 1535 ♂ 14-3-30 Sankrametta 3,500 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
2 ♀	14.5-15	81.5-85.5	89-92	17.5-18 mm.
4 ♀	13.5-14.5	78.5-85	85-90.5	17-18.5 mm.

As stated long ago by Jerdon the White-browed Fantail Flycatcher appears to be far less common in the South than in the North of India. We have really very little information about it in the Madras Presidency though it appears to be fairly generally distributed in small numbers as a resident species. On the Eastern side, our information is solely based on the above specimens, a specimen in my own collection from St. Thomas' Mount, dated 16-3-1900 and Dewar's remark that at Madras it is not very abundant though by no means rare.

On the Western side we have seen specimens from Cannanore (♂ 13th. March, Col. H. R. Baker: ♂ 15th September, Wardlaw-Ramsay). William Davison says that he had only seen it once or twice in the Wynaad. In Travancore, according to Ferguson, it is common in the low country and breeds there in April.

We are aware that Dewar (J.B.N.H.S., xvi. p. 154), considered it very numerous at Coonoor and Fairbank (S.F., v, 401), stated that he had found it up to 4,000 ft. in the Palnis. But as both these authors omit *pectoralis* from their lists we consider that there has probably been some error in identification.

In the *New Fauna* Mr. Stuart Baker confines the range of *compressirostris* to Ceylon and S. Travancore, while the rest of India proper and Assam north of the Brahmaputra is given as the range of the typical race. It is difficult to make out the correct distribution and division of the races of this species partly because there is no adequate series available in the British Museum from Bengal the type locality, partly because this species is difficult to skin and most specimens in collections are therefore very poorly prepared, and partly because the differences are slight and the colour changes with abrasion. We are however unable to see how our Survey specimens can be separated from the Ceylon race.

If birds from Ceylon are compared with birds from the Punjab and Sindh they will be found to differ as follows:—

aureola	*compressirostris*
1. One central pair of tail feathers black without white tips.	1. Two central pairs of tail feathers black without white tips.
2. White tips of outer pair of tail feathers extensive, about three-quarters of the length of the feather and reaching the under tail coverts.	2. White tips of outer pair of tail feathers less extensive, only about one half of the length of the feather, and not reaching the under-tail coverts.
3. Upper plumage slightly paler when fresh mounted.	3. Upper plumage slightly darker, more sooty, when fresh moulted.
4. Tail longer ♂ 89-100 mm.	4. Tail shorter ♂ 82.5-87.5.

On these characteristics our Survey series are most certainly *compressirostris* as are all birds which we have examined from the Madras Presidency including Travancore and Southern Mysore.

There is however complete intergradation between the two forms and it may ultimately be found more satisfactory to recognise three races, of which the typical is the intermediate. Before this is done however it will be necessary to examine a proper series from Bengal and the centre of the Peninsula, and these are not at present available.

The difference between the nests of this species and *pectoralis* which is overlooked in the *New Fauna* has been recorded by Mr. D'Abreu (J.B.N.H.S., xxxv, p. 217), and independently reported to me by Capt. R. S. P. Bates.

Leucocirca pectoralis pectoralis Jerdon.

Leucocirca pectoralis Jerdon, Ill. Ind. Orn., Text to pl. ii (1845 before March)—Nilgiris.

Specimens collected:—108 ♀ 22-4-29, 195 ♂ 6-5-29, Kurumbapatti; 448 ♀ 19-6-29, Harur 1,000 ft.; 750 ♂ 26-8-29, Palkonda Hills 1,000 ft.; 964-5 ♀♂ 3-11-29, Nallamallai Range 2,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	14-14.5	73.5-76	90-93.5	18-18.5 mm.
3 ♀	13-14	70-74	86-94	17-18 mm.

The White-spotted Fantail Flycatcher does not appear to have been recorded on the eastern side of the Presidency until the Survey found specimens in the above four localities. On the west it is of course well-known. It occurs in the Wynaad (though as yet unrecorded from Coorg and Malabar) and in the Nilgiris is exceedingly common[1], mostly between 5,000 and 6,000 feet according to William Davison. We do not find any published authority for the statement that it occurs in Travancore. Terry recorded that in the Palnis he found it far from common in the Pittur valley but we feel that there may be some mistake about this. At any rate Captain Bates informs us that he never observed it during a residence of two months in the Palnis, and Terry's list does not include *L. aureola* which is not uncommon at lower elevations in those hills.

In the Nilgiris the breeding season is from April to July. The female obtained at Kurumbapatti in April was about to lay eggs.

Leucocirca pectoralis vernayi Whistler.

Leucocirca pectoralis vernayi Whistler Bull. B. O. C., vol. lii, cccliv. (Dec. 1931) p. 40—Jeypore Agency 3,000 feet; upper Eastern Ghats.

Specimens collected.—1384 ♂ 1387 ♀ 13-2-30, 1410 ♀ 19-2-30, 1755 ♀ 2-5-30 Anantagiri 3,000 feet; 1620 ♂ 28-3-30, 1628 ♂ 30-3-30 Sankarametta 3,000 feet: 1700 A ♂ 18-4-30, 1730 ♂ 26-4-30 Jeypore Agency 3,000 ft.

Measurements—

	Bill.	Wing.	Tail.	Tarsus.
5 ♂	13.5-15.5	72-81	93-104.5	18-19 mm.
3 ♀	13-13.5	70-73.5	88-96	18-18.5 mm.

Extremely common all over the whole area visited in the Vizagapatam Ghats. Specimens obtainded were in varying degrees of genital development in March and April (La Personne).

This is another of the interesting new forms obtained by the Survey in the upper Eastern Ghats. It is easily distinguished from the typical form by the far broader pectoral band which is also continued downwards as an extensive dark wash on the flanks. The white spots on the pectoral band are much reduced, both in size and number and they are mostly confined to the posterior edge of the band. The upper parts are slightly paler and browner in tint. The fulvous wash on the abdomen is darker, and the lateral tail-feathers are also washed with fulvous.

(To be continued).

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[1] An amusing incident during the photographing of this species is related by Bates (J.B.N.H.S., xxxi, p. 289).

THE ANDAMAN SHELL FISHERY.[1]

BY

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Zoological Survey of India, Calcutta; and Royal Institute of Science, Bombay.

(*With 5 plates*).

The marine life of the Andaman Seas has been so frequently referred to by distinguished workers on the fauna of those Seas that an apology may seem necessary for the present attempt. The teeming variety of specimens for investigation, the strange methods of obtaining them and the sight of the hardy and industrious Japanese constantly and fearlessly diving into the deep for the wherewithal of their existence furnish fruitful topics for description, the interest of which can never be exhausted; and though the present sketch may add nothing new to the literature of the conditions round the Andamans it is an effort to set forth things in general and the fishing methods of the Japanese in particular as they appeared to the writer.

The Andaman Islands consist of a chain of islands about 204 in number and lie in the Bay of Bengal. The average width of the chain is 15 miles and the length, excluding the Little Andamans, which lie 40 miles off the South Andamans, is about 145 miles. The chief islands, starting from the North, are: North Andaman, Baratang, South Andaman, and Little Andaman. Port Blair, the main settlement, is on the east coast of South Andaman. The Andamans are about 780 miles from the mouth of the Hooghly and 120 miles from Cape Negrais in Burma.

The story of the strange commencement and growth of the Andaman shell fishery constitutes an interesting chapter in the history of the shell fishery in India. In the early days of the industry, when the Port Blair authorities were apprised of the fact that the Japanese were carrying shells from areas round the adjoining islands, investigators were sent from the Indian Museum (Zoological Survey of India) Calcutta, to inspect the local conditions. Later attempts resulted in the bestowal of continuous attention on the fishery and the results of such observations have been recorded and kept up to date. It is remarkable that the

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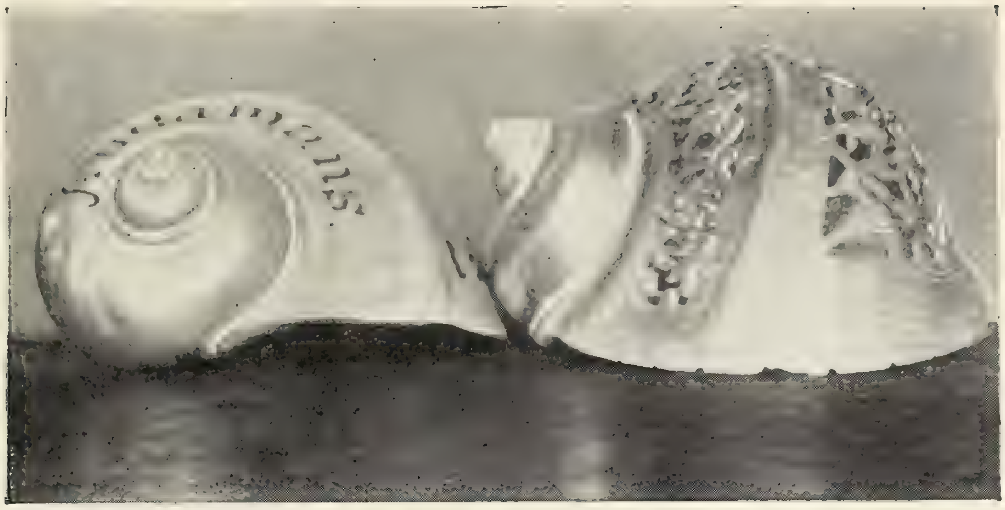
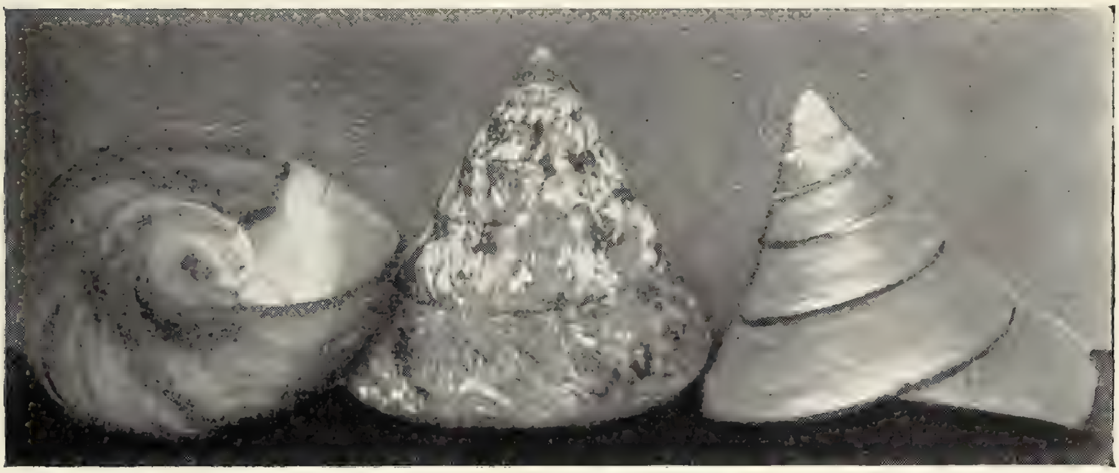
[1] I take this opportunity of expressing my thanks to Lieut.-Col. R. B. S. Sewell, late Director of the Zoological Survey of India, who made it possible for me to be in the Andamans for a year as Fisheries Officer. I am also indebted to him for various invaluable suggestions I received from him in connection with the work. For permission to publish a short general account of the Andaman shell fishery I am indebted to the authorities of the Indian Museum, from the members of whose staff, specially Dr. Baini Prashad and Dr. S. L. Hora, I obtained considerable assistance. My thanks are also due to Col. Ferrar, Chief Commissioner of the Andamans, who afforded me every facility for the execution of the work.



1. Artistically carved shells of *Turbo*.



2. Shells chemically treated to expose pearly layer. (Central shell untreated for comparison.)

3. Japanese crew at shell banks.

organised development of the fisheries on a systematic basis was not undertaken years ago.

Shells in Commercial Use.

About a dozen species of the Gastropod mollusc of the Family *Trochidæ* (top-shells) and the Family *Turbinidæ* are found throughout the Andamans, but only two species *Trochus niloticus* Linn, a most abundantly distributed species, and *Turbo marmoratus* Linn, found in very small quantities, have a beautiful pearly appearance on the inside. Commercially therefore these are extremely valuable and are in very great demand for the pearl button manufacture. The two genera *Trochus* and *Turbo* are easily distinguishable by the structure and nature of the operculum. The operculum in both these genera is a well developed structure situated on the foot, and serves as a very efficient door to close the mouth of the shell when the animal withdraws itself inside. In *Trochus* the operculum is horny and has its outer surface marked with a spiral. In *Turbo* the operculum is stony in nature. It is a heavy structure and is large enough to be used as a paper weight and is therefore not without value.

Distribution and Supply.

Regarding the *Trochus*, it may be mentioned that the Andamans are not the only fishing grounds. France has produced thousands of tons of *Trochus*. When *Trochus* shells were first in demand they came exclusively from Singapore and the neighbouring islands, but later on *Trochus* began to be fished all over the world. The Red Sea fisheries produce thousands of tons. The Fiji islands, New Caledonia and Australia are also producing *Trochus* for commercial purposes. Recently Japan has promoted the *Trochus* fishery. The fisheries of the Queensland coast of Australia have been exclusively worked by Japan to which place the shells were shipped immediately from the fishing grounds.

Turbo marmoratus is obtained in Penang, Singapore, Mergui, Australia and New Guinea. In appearance, both the *Trochus* and the *Turbo* have a beautiful pearly lustre on the interior. Besides the commercial value of these species for the manufacture of pearl buttons, their flesh is edible and forms one of the sources of sustenance of the Japanese fishermen during the time they are fishing. Both species are extensively used for enhancing the attractiveness of ordinary articles. They are also employed in the manufacture of a large variety of articles, such as buckles for shoes, knife handles, serviette rings, toilet objects, fruit dishes and for artistic inlaid work. Various artistic engravings are also worked out on shells. Having considered the fishery in its general outlines, I shall now describe some of its more detailed features.

Japanese start Andamans Industry.

When the Japanese first started fishing, their operations were confined to the region round the Nicobars, where they fished for some years. From this region quite a quantity of shells was removed with the result that the areas were almost depleted. This depletion became so acute that the Japanese were compelled to move to virgin waters and it was when they were in the neighbourhood of the North Andamans that they were accidentally detected shelling by the captain of a steamer on the regular Calcutta-Andaman Service. All this while, it should be noted in passing—the Japanese carried on their operations furtively without the knowledge of the authorities. It is thus to a mere accident that we owe the discovery and subsequent development of the Andaman fisheries. The shells in the possession of those Japanese who were caught shelling were confiscated and later sold. The whole incident has been well and graphically described in the records in possession of the Chief Commissioner at Port Blair. Many such cases of poaching were discovered and the poachers were fined heavy amounts for fishing for shells without licences. The extent to which poaching had been practised is of course unknown, but there is no doubt that it was followed by the denudation of the entire area in the neighbourhood of the Nicobars and evidence of this is afforded by the Japanese themselves who now find fishing there unremunerative and openly avow it.

The fishing season begins in October, when the Japanese come forward to register their names for the ensuing season. In the first year of the industry licences were granted to several Japanese firms but, later, stricter regulations were enforced to protect the fisheries with the result that the same large number of Japanese who fished in the first year is not forthcoming. During the season 1930-1931 licences were granted to two firms only and a fleet of six vessels belonging to them was engaged in fishing. The two firms had their representatives stationed at Port Blair.

Intrepidity of Japanese Fishermen.

Prior to the season under review, the practice was to collect a definite quantity of shells from any section of the islands within a specified period, but the Japanese sometimes experienced difficulty in fishing the allotted quantity during the specified time and the terms of the licences were somewhat modified. The course followed in the beginning of the present season which, it may incidentally be observed, has now been given up, was to do away with the time limit and to allot a definite area to each boat. The area where they have to shell is specified in the licence.

Obviously during the south-west monsoon, no fishing at all is done and even during October to May when fishing is done stormy weather and rough seas at times prevail on the north-east coast owing to the north-east monsoon. Though this monsoon is not as severe as the south-west, it nevertheless seriously interferes at times with the fishing, the wind and rain compelling the fishing crew to take shelter on the west coast. Another factor is the visibility of the waters, which are frequently rendered turbid and greatly hamper the fishing operations. As the visibility in the waters is reduced, the divers cannot distinguish objects underneath, and they are disinclined to fish on account of the sharks which have the better of them under these conditions. In this

1. Typical Japanese boat.

2. View of holds in which shells are stored.

3. A close up of fishermen ready for operations.

1. A typical sampan on its way to fishing grounds.

2. The unattended sampans. The fishermen are seen in the water.

3. A loaded sampan alongside motor-boat.

locality the danger from man-eating sharks is very great, various dangerous species of sharks being found in the neighbourhood of these shell-beds. As a result of these perils to which fishermen are exposed, one man recently lost his life. In this particular instance the man was picking up shells at a depth of about five fathoms when he was attacked by a shark and lost an entire limb from the thigh to the foot. In this connection it would not be out of place to refer to the intrepidity and fearlessness of the Japanese fishermen who, sometimes with great skill and imminent risk to their lives, perform marvellous feats in beating off attacks of sharks.

BOATS AND EQUIPMENT.

The first aspect that forcibly strikes the mind of the observer and fixes his attention is the extraordinary hardiness, fearless courage and great perseverance of the Japanese in securing the shells. This is the principal object of their mission and in order to obtain it they have first to make the long and tedious trip from Singapore to the Andamans. Motor-launch transport is not the pleasantest method of accomplishing so long a voyage and, besides the insufficiency of the accommodation, the members of the crew have to undergo the further discomforts of being exposed to the inclemencies of sun, wind and rain. The fact that they successfully perform the voyage despite such handicaps must arouse admiration, which is further enhanced when it is known that they have achieved the primary object, which is the collection of shells for commercial purposes. Here it would not be out of place to refer to the equipment of the boats.

The hands engaged on them are almost exclusively recruited from the Japanese. The usual type of boat is manned by a crew of about eight divers, a master navigator (captain), and an engineer to drive the engine. The captain is usually the manager and the director of the work. The divers have no special kit. To protect their eyes they wear home-made goggles of ordinary glass mounted in a wooden frame and secured by twine or strong rubber tubing round the head. Not one of the number of the divers is familiar with English yet despite their ignorance of the language they, curiously enough, have with them the most recent Admiralty charts of the waters in which they propose fishing. The sole nautical instrument on board is a compass with the addition of a pair of binoculars.

The boats are generally uniform in type and structure. They are fitted with powerful engines which generate sufficient energy to enable them to travel round the islands and along the coastline. The size of the boats vary at times but on an average the space from stem to stern is between 40 to 60 feet. They have a carrying capacity of about 18 tons of shells and the gross tonnage of any boat is about 25 tons. The deck space from the tip of the stern to the steering wheel is covered with numerous 'hatches' for storing away the shells. In Japan these boats are used for the Tunny fishery. Each of these motor-boats has attending on them three or four sampans (paddle boats) which are towed by the former. The sampans are light, small craft used to approach the shell beds, on the rocky ledges where the fishing is to be done. The motor-boats, on account of their large size, cannot approach the fishing areas owing to the fear of submerged rocks. When the divers reach the shell beds and are about to jump into the water, they fill their lungs several times with air and expel it. Finally as they are about to jump, they take in one final deep breath and plunge in, sinking several fathoms below the water. They next secure as many shells as possible, which are put into a small net-bag secured round the waist. The divers remain submerged for a little over two minutes. When they are unable to stay any longer, they ascend to the surface and transfer whatever shells they may have secured and are in their bag into another larger bag floating on the surface of the water and to which an empty petrol tin is attached.

Japanese Fishing Methods.

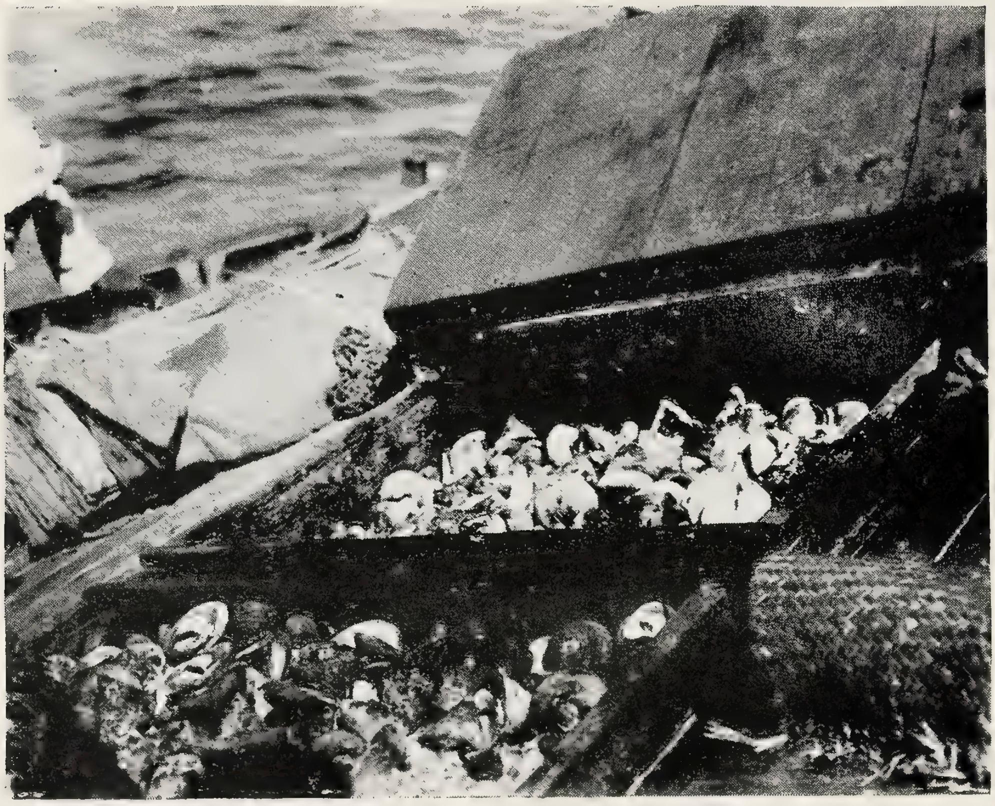
The shells are stowed away in this bag as they are picked up and this process of rising above the water and diving underneath continues till the bag is completely full. Its contents are then emptied into the sampan. The Japanese divers are very daring and they have been known to venture as much as 15 fathoms deep, but under these conditions they make their appearance much quicker and their working time is considerably shortened. The diving operations last for about three to four hours during which the sampan floats unattended. The divers then row the sampan back to the motor-boat, on to the deck of which are poured out all the shells in the sampans. This process goes on till the maximum storage capacity of the motor-boat has been reached, and this takes from about 20-40 days depending upon the productivity of the shell beds. The sampans leave at about seven in the morning, and at mid-day, when the divers return for food after strenuous work, a hot meal, usually of rice and fish, awaits them.

When diving is suspended the main work is to treat the shells fished. The entire crew, including the captain and the engineer, then start extracting the animals from the shells. This lessens to a very great extent the weight of the cargo of the shells on the homeward trip of the motor boat. The animals also serve as comestibles, for their head and foot regions are carefully strung and dried for consumption later. The entire animal in the case of the *Trochus* cannot be easily removed, as the organs which lie in the upper whorls of the shell do not yield easily to the process of extraction. The instrument used for the purpose of extraction, in the case of both the shell fish, consists of a stout steel wire with a sharp point at one end and a wooden handle at the other.

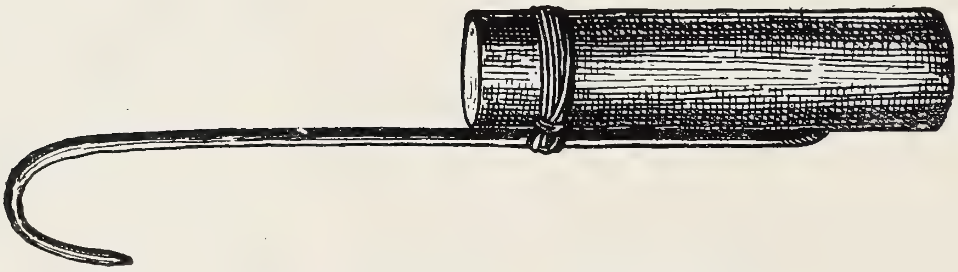
The instrument resembles a gimlet bent at the point. After the extraction of the animal, the shells are stored in the holds, where flies and maggots completely eat out what has been left behind. The stench emanating from such shells is unbearable. In the case of the *Turbo* shells, which are provided with a hard calcareous operculum, these are kept on the deck till the animal creeps out. The insertion of the instrument before this has not

1. Discharging the cargo of the sampan into the launch.

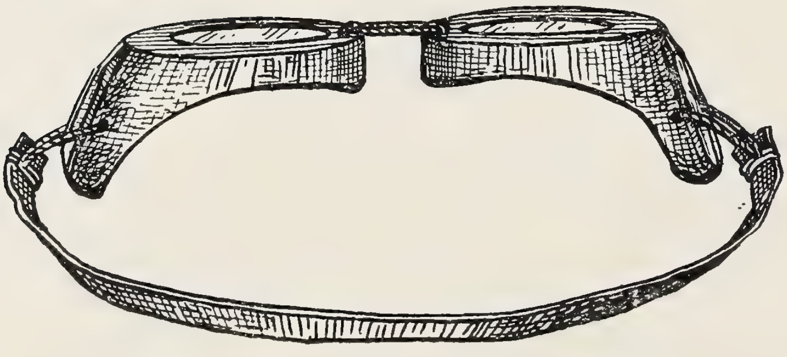
2. Removing animals preparatory to storage in holds.



1. Holds stocked with shells.



2. Instrument used for removal of animals.



3. Home-made goggles used by divers.

much effect as it cannot reach the soft parts on account of the thick and heavy operculum. This method, if not better, is no doubt quicker than the one employed in the Philippines, where the shells required for commercial purposes are buried in the ground for at least a month and then washed in sea water.

DIVISION OF PROFITS.

It would not be out of place here to describe the status of the various divers and their manner of the division of the proceeds realised from the sale of the shells. The fishing boats, on their return from collecting shells, inform the Deputy Commissioner of their arrival in the harbour. The Fisheries Officer examines the holds to see whether the allotted amounts have been collected and also whether the shells are of the specified size. The Deputy Commissioner next receives payment for the shells after which the boats leave for Singapore, to return to the Andamans again within a fortnight to resume fishing operations. Each boat makes two or three such backward and forward trips. At the end of each trip to Singapore, the captain and the crew are paid off. According to their competency and ability for work, the divers are classified into three and sometimes into four grades. The captain of the motor-boat, the engineer and about three or four best divers are placed in class I, while the remaining grades are composed of men according to their efficiency of work. The proceeds of the sale of the shells are distributed among the four grades of the divers in the proportion of 10, 9, 8, 7. This method seems rather strange and likely to give cause for misunderstanding and dispute, but, far from there being any disagreement the divers display remarkable comradeship and team spirit. This arises from the fact that they are not the paid servants of any firm or employers, but their own masters and their earnings are strictly dependent on their efficiency of work. The desire to excel one another acts as a powerful incentive and all are very enthusiastic about their work. The greater their efficiency, the bigger their catch, and correspondingly a larger share in the division of the net gains. A diver in class I on an average earns about Rs. 300 a month. Their wants are few, expenses accordingly small, and their net income therefore amounts to an attractive figure. The staple diet of the divers consists of boiled rice and fish, which is caught by the divers as the motor-boat is on the run. If no fish is got by means of the line, the divers jump in and spear the fish in their hiding places among the coral reefs. Besides rice, the provisions aboard consist of onions, potatoes, Japanese sauce, tobacco and apples, all brought from Singapore. The normal cost (inclusive of all running expenses) on a trip from Singapore to the Andamans averages about Rs. 200, which is not much considering the cruise lasts for about a week. It will be seen that for a small outlay a handsome profit awaits their enterprise, privations and discomforts. Fortunately a check has been placed on their enterprising zeal, for their unrestricted activities threatened to denude the Andamans of its shell fauna.

Shell-fish Census.

During the period under review a survey of the Andaman waters was carried out with the object of making a preliminary survey of the fishing grounds. It included an investigation of the location of the beds, density of the shells and other features which, it was thought, would serve as a basis for future work. The coast line for the most part was traversed in Japanese vessels. Information was also indirectly collected by the following method. A number of maps of the areas allotted to the two firms was prepared and these were given to the captains of the six boats with instructions to locate on the maps the sites of the beds, their extent, the number of shells fished, the time taken and other miscellaneous details.

The preliminary information gathered on the survey has led to several interesting conclusions. I may point out that though the information extends to only six months' work in the locality, it nevertheless, more or less fairly represents the quantity of shells available round these islands. Among the important data yielded by the shell fish census is the interesting fact that both *Trochus* and *Turbo* are gregarious and inhabit distinct beds. The densest shell areas lie chiefly round the islands, rather than along the main coast and are also higher at the southern end than at the northern end of the group. The greater part of the catches were made at depths varying from two to nine fathoms. Both the varieties of shell fish are confined to the zone below low tide line and scarcely extend more than ten fathoms below low water. *Trochus* beds, particularly, are found near the outer edge, on the extensive coral reefs which fringe these islands. It may be assumed that in the neighbourhood of these areas the molluscs seem to find abundance of lime as well as food and other conditions favourable for reproduction and growth. A survey of the reefs in neighbourhood of these islands, including their geology, oceanographical conditions, flora and fauna will be invaluable to scientists and it may be mentioned that an attempt has already been made to undertake this task.

THE BLACK AND BROWN BEARS OF EUROPE AND ASIA.

BY

R. I. Pocock, F.R.S.

(*Unofficial Assistant in the Zoological Department of the British Museum*).

PART II.

(*With 2 plates and 12 text-figures.*)

(*Continued from page 823 of Volume XXXV*).

The Sloth Bear (*Melursus*), The Himalayan Black Bear (*Selenarctos*) and the Malayan Bear (*Helarctos*).

Genus: MELURSUS, Meyer.

Melursus, Meyer, *Zool. Entdeckung*, p. 155, 1793; and of most recent authors including Blanford, *Mamm. Brit. India*, p. 200, 1888, and Pocock, *Ann. Mag. Nat. Hist.* (9), I, p. 383, 1918.

Arceus, Goldfuss, *Verh. Nat. Säug.*, pp. 301-302, 1809.

Prochilus, Illiger, *Prodr. Syst. Mamm.*, pp. 109-110, 1811.

Chondrorhynchus, G. Fischer, *Zoogn.* III, pp. 142-143, 1814.

Notes on the synonymy.—It is needless to discuss in detail the generic names in this list since they all have the same type-species, namely, the bear described as *Bradypus ursinus* by Shaw referred to below under the specific synonymy.

In admitting the genus as distinct from *Ursus*, Blanford and others laid particular stress upon the dentition, especially upon the suppression of the median pair of upper incisors. Subsequently I pointed out some supplementary generic features connected with the feet and the rhinarium, amplifying in some detail structural peculiarities in the nose indicated by Shaw's original figure and description.

Diagnosis.—Feet an extreme modification of those of the Brown Bear (*Ursus*), with the five digital pads nearly in line and fused up to their distal ends; but with the area between these pads and the plantar pad and the area round the carpal pads on the fore foot naked; also the area above the carpal pads is scantily clothed with short hair. Ears large as in *Ursus*. Rhinarium distinctive, transversely elongated, without philtrum and without median groove, its upper edge mobile, overhanging and capable of being closed over the nostrils; its lateral edges also projecting. The lips and tongue highly protrusible.

Skull also an extreme modification of that of *Ursus*, very like it in proportions and in profile view; but with the mouth and teeth adapted for a different sort of diet, much of which is imbibed by suction. The following are the principal differences from the skull of *Ursus*:—the jaws are 'undershot', the lower incisors projecting slightly beyond the upper; the median upper incisor teeth are absent[1] to leave a gap through which food is sucked into the mouth; the first three premolars above and below better developed than in *Ursus* and persistent; the edge of the mandible which bears the lower ones straight, not concave as in *Ursus*, so that there is no postcanine biting space (see figs. of skulls and teeth in Part I of this paper); the back cheek-teeth much smaller, the last upper molar only about the size of the molar in front of it, and the first of the three lower molars longer than the second. The post-dental part of the palate is very long and wide, thrusting the posterior nares backwards, as in some anteaters; from that point forwards the palate is hollowed almost to the canines whence it inclines upwards to the incisive border.

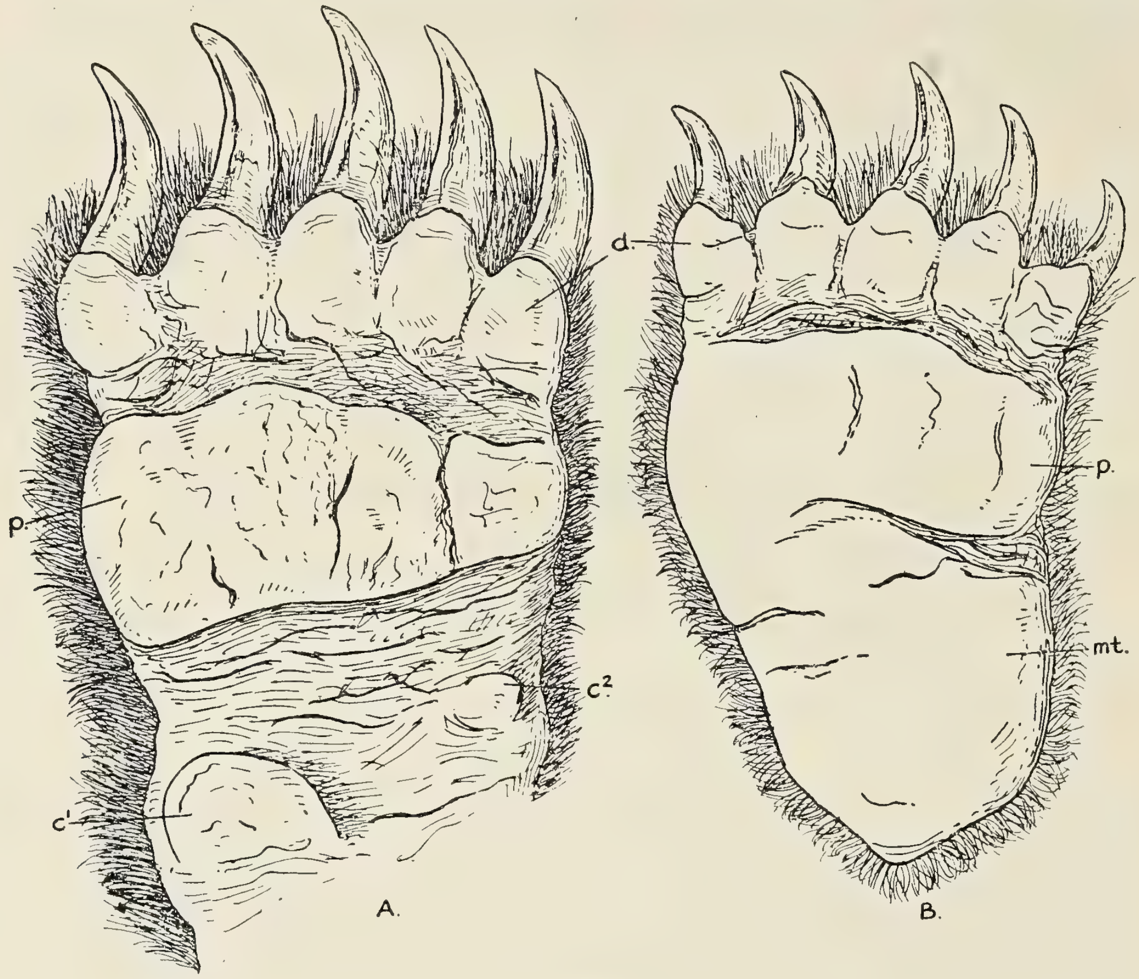


Fig. 1.

A. Lower side of right fore paw of the Sloth Bear (*Melursus ursinus*). B. Lower side of right hind paw of the same. C¹. external carpal pad; C². internal carpal pad; *mt.* metatarsal pad; *p.* plantar pad; *d.* digital pad; 1 fifth digit; 5 first digit (these digits inadvertently wrongly numbered).

In connection with the claim of kinship between *Melursus* and *Ursus* here put forward from consideration of the feet and skulls, it may be recalled that Lydekker came to the same opinion from the examination of the skull of an extinct Pliocene bear (*Ursus*

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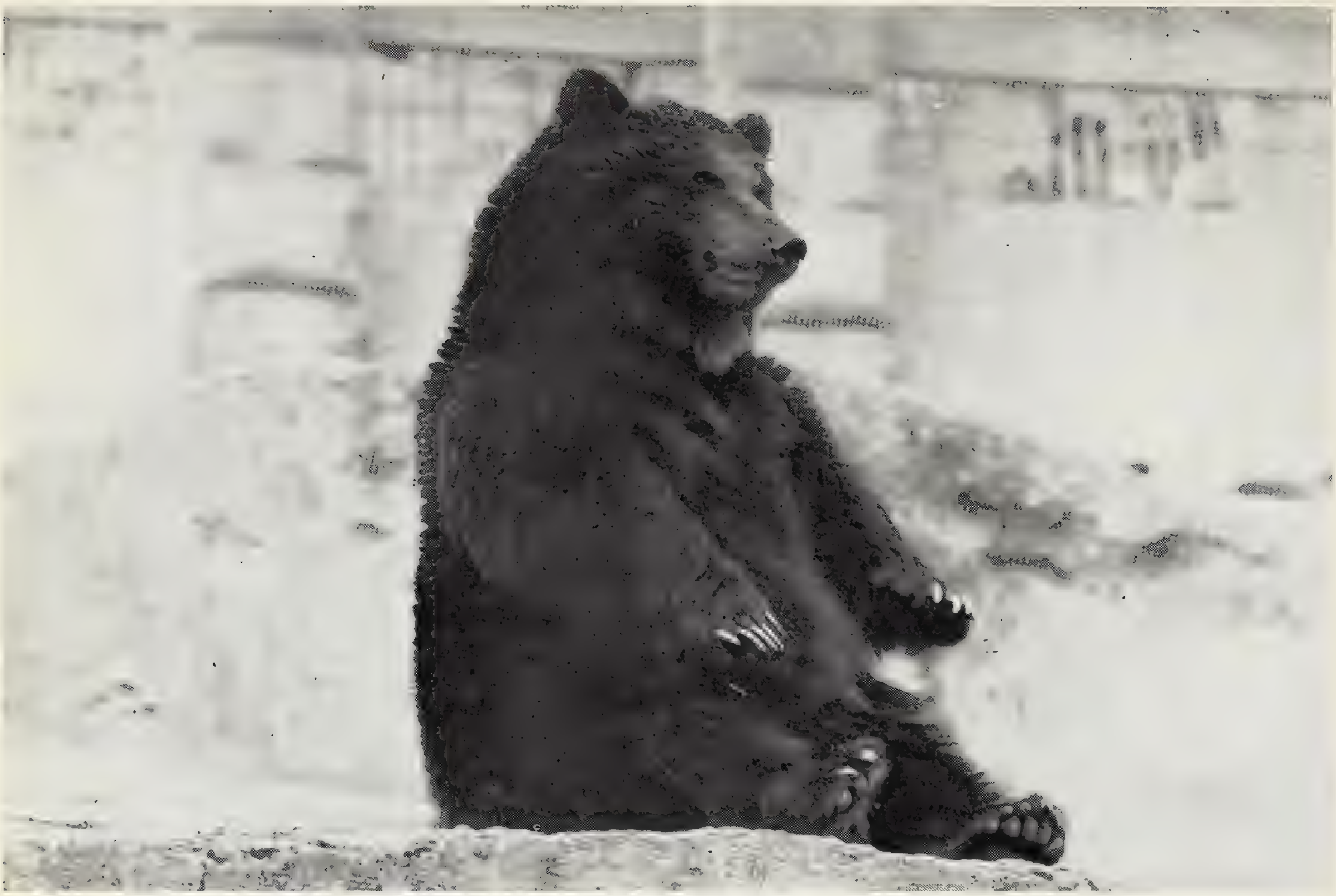
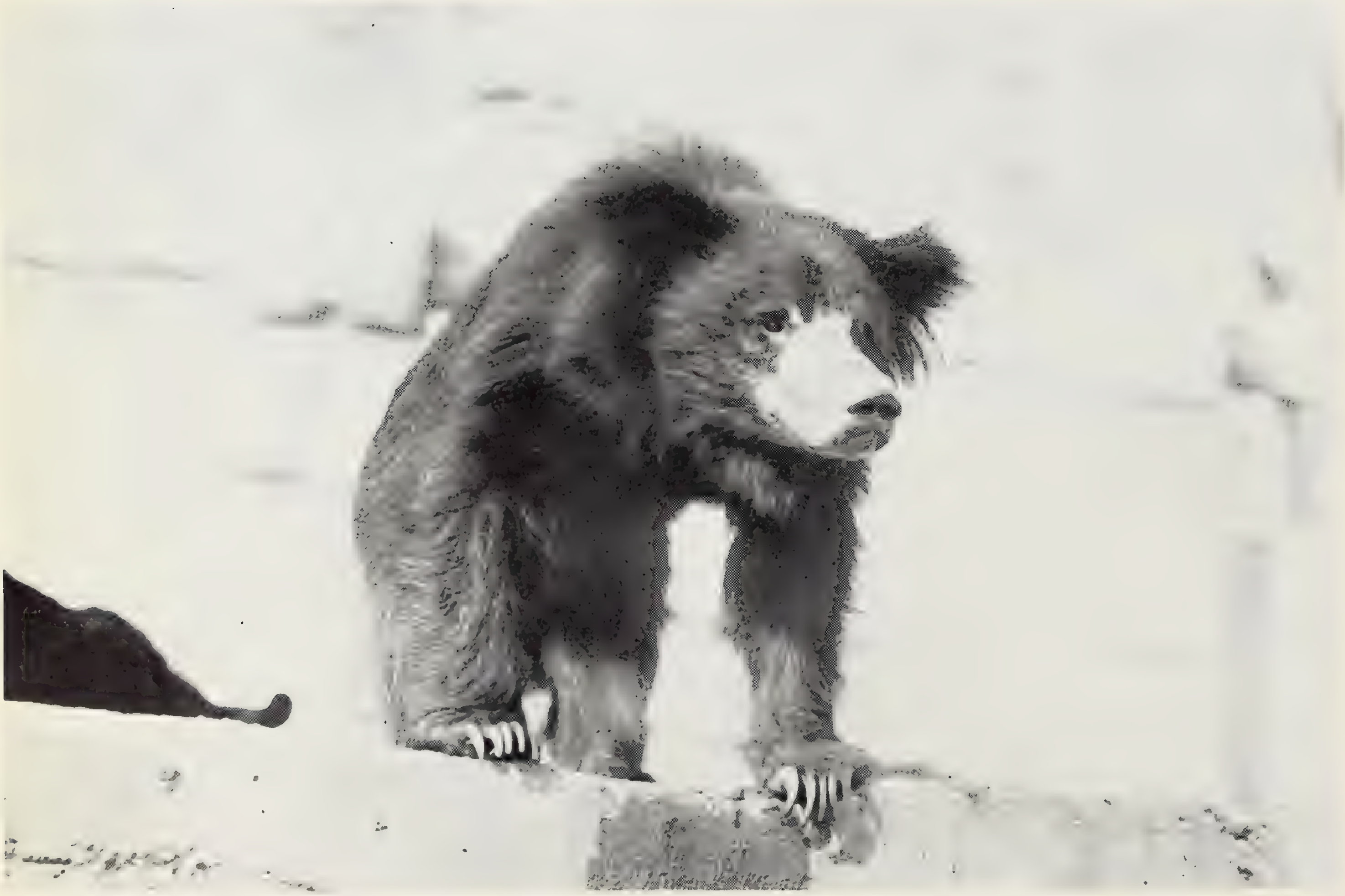
[1] These teeth are present although reduced in size in the milk dentition.



Russian Brown Bear (*Ursus arctos*)



Sloth Bear (*Melursus ursinus*)

VITTY & SEABORNE, LTD.

theobaldi) from the Siwalik Hills. The teeth of this bear were intermediate in size between those of *Melursus* and *Ursus*.

Melursus ursinus, Shaw.

Melursus ursinus ursinus, Shaw.

Bradypus ursinus, Shaw, *Nat. Misc.*, ii (unpaged), pls. 58-59, 1791; *id. Zool. Mamm.*, i, p. 159, pl. 47, 1800; and of recent authors under *Melursus*.

Melursus lybius, Meyer, *Zool. Entdeckung*, p. 156, 1793.

Arceus niger, Goldfuss, *Verh. Nat. Säug.*, p. 301, 1809.

Ursus labiatus, Blainville, *Bull. Soc. Philom.*, 1817, p. 74; and of many later writers.

Ursus longirostris, Tiedemann, *Abhandl.*, p.l., pl. 1820.

Typical locality.—Patna, north of the Ganges, Bengal.

Distribution.—Peninsular India from Cape Comorin northwards to Gujerat, Assam and the foothills of the Himalayas.

Notes on the synonymy.—The type of the Sloth Bear was a living example, exhibited in London, and described and figured

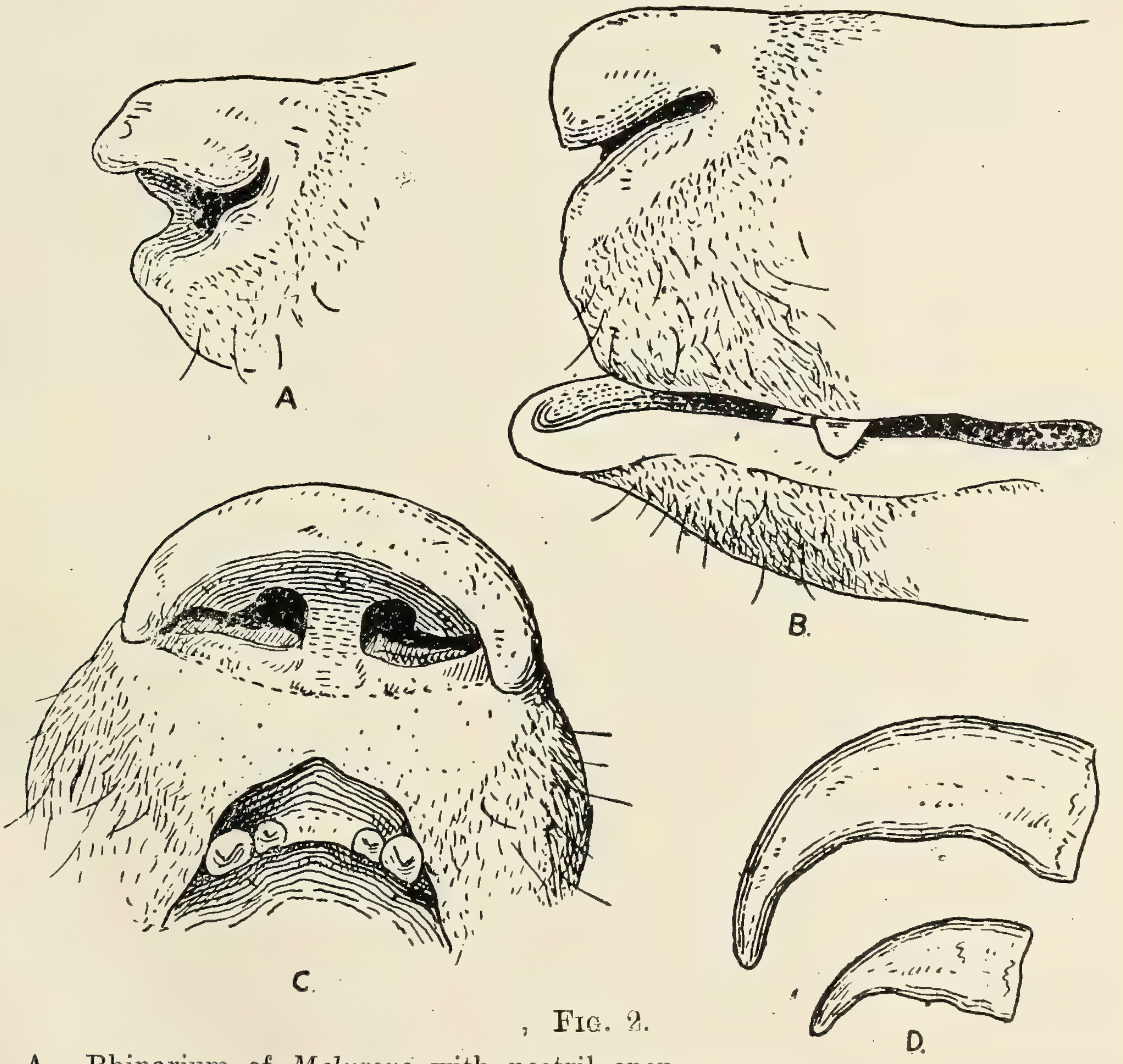


Fig. 2.

A. Rhinarium of *Melursus* with nostril open.
B. End of muzzle of the same showing the nostril closed and the lower lip partially protruded.
C. Front view of the upper jaw of the same showing the rhinarium and the mediam gap in the incisor teeth.
D. Claws of fore and hind paw of the same.

by Shaw, who, misled by the entire absence of its incisor teeth, took it for a new species of Sloth (*Bradypus*). In this opinion he had the support of Pennant; and very naturally the animal excited a good deal of contemporary interest, especially on the Continent. A figure and description of it were also published by Delaméterie (*Journ. de Physique*, Vol. 40, pp. 136 and 404, pl. 1, 1792), who stated that it had been imported from the interior of Africa. Hence, Meyer, guided by Delaméterie's account and perceiving from his illustration that the animal was a bear, described it as *Melursus lybius*. The animal nevertheless was secured at Patna, as Shaw recorded. Subsequently Goldfuss, Blainville and Tiedemann respectively described the same animal as *niger, labiatus* and *longirostris*. As *Ursus labiatus* the species was described and figured by both G. and F. Cuvier, who, on Duvaucel's authority, recorded it from Sylhet. Many subsequent writers adopted that name.

Description.—Coat varying according to season in colour, thickness and length. When full exceedingly long and thick, with the hairs straight or wavy and, before the moult, coalescing into long tufts as in *Ursus*. Underwool sometimes, but not always, distinguishable from the rest of the coat. The muzzle always very short-haired, the long hair setting in at the level of the ears and longest on the back just behind the shoulder where it forms a mat recalling the shoulder-mat of *Ursus*. Colour typically black, frequently brownish, sometimes wholly brown, sometimes partly grey; the muzzle always mealy; the 'collar' varying from white to almost chestnut, typically V-shaped. Claws pale whitish-horn.

For the loan of several of the skins noted below I am indebted to the Bombay Natural History Society. These are indicated B.N.H.S. Two of these, collected for the Mammal Survey, one in Bengal by C. A. Crump, the other in Ceylon by Major E. W. Mayor, are dated and show that the moult takes place in the summer. Of the skins in the British Museum one only is dated.

1. North Malni, C.P. (Mrs. Cosens. Nos. 28, 10, 12, 6.). Colour black, with the collar brownish buff, crescentic, its arms about 3½ ins. long, expanding above to a little over 2½ ins. wide. Coat long, shaggy, somewhat tufted, about 6½ ins. long on the sides of the neck and just behind the shoulder, 6 ins. on the flanks and 4 ins. on the loins and rump. The skin, apparently unstretched, measures 4 ft. 7 ins. long. This bear was shot on February 12th.

2. Palamau in Chota Nagpur (Capt. S. N. Walker, Nos. 24, 10, 9, 8.). Black with a decided brownish tinge, owing to the hair-tips being dead, curled and faded to that tint, on the fore quarters and hind paws. The collar brownish-buff, asymmetrical, broad behind, with transverse posterior border, its right arm much thicker than the left. Coat long, shaggy and thick but shabbier-looking than in No. 1, the hair from 7 to 8 ins. on the sides of the neck and behind the shoulder, 5 to 6 ins. on the flanks, on the belly short and thin. The skin, made up as a rug, measures 5 ft. 3 ins.

3. Same locality and history (Nos. 24, 10, 8, 7.). Like the last, but collar very differently shaped being crescentic with the arms broader at their anterior or upper ends. Coat a little shorter, hairs 6 to 6½ ins. on sides of neck and behind shoulder, 5 ins. on flanks. The skin, similarly made up, measures 6 ft.

4. Jhansi District (Mrs. Fischer, Nos. 0, 7, 2, 1.). An undated, mounted skin, black in colour and with perfect coat, the hair over 8 ins. on the sides of the neck, 7 ins. on the mat and on the flanks. The length is 5 ft. 8 ins. and the standing height 2 ft. 10 ins.

5. Nimiaghat, Hazaribagh in Bengal (B.N.H.S. C. A. Crump.). Skin dated June 12th, 1914. Coat very shabby, dull and dead-looking, consisting largely of thick, tangled brown woolly hair, which, when the black tipped hairs are disarranged, gives a brown hue to the skin; a good deal of brown on the head and paws. Hair on sides of neck about 6 ins., on back 4½ ins., scanty on rump and belly. Arms of V-shaped collar about 12 ins. long by 1½ ins. wide. Front claws 2.7 ins. long in a straight line from base above to tip; hind claws 1.2 ins.

6. Meleghat, Chickalda, Berar. (B.N.H.S.). General colour of back blackish brown, quite brown on sides of neck, flanks, belly and limbs. Collar yellowish buff, well developed, crescentic. Hair on sides of neck and behind shoulder 5½ to 6½ ins., on nape 1½ ins., on back 4 ins. Underwool pale greyish brown.

7. Rajora, Hydrabad (B.N.H.S. B. Devlin.). All black; with V-shaped collar dirty white, small, its arms about 4 to 5 ins. long. Coat very long, thick and shaggy, massed in long tufts; hairs 9 to 10 ins. long on the neck, shoulders and flanks, 5 ins. on the back.

MELURSUS URSINUS INORNATUS, Puch.

Melursus inornatus, Pucheran, *Rev. Mag. Zool.*, v, p. 392, 1855.
Type locality.—Ceylon.

Pucheran gave the name *inornatus* to a young specimen of the Sloth Bear from Ceylon because it differed from the typical Indian form by having no white mark on the chest. He also claimed that the skull was more elliptical than Indian skulls of the same age. I have seen no adult skulls from Ceylon; but I retain Pucheran's name in a subspecific sense because Ceylonese skins seem to be much shorter coated than the skins from north India.

The only examples from Ceylon I have seen are the skins of two males shot on May 13th at Kumbukkan in Uva by Major E. W. Mayor for the Mammal Survey and two immature skulls, one from Kumbukkan obtained by the same collector but not belonging to either of the skins, the other ticketed South Ceylon (Miss Bevan), presented to the Museum by the Bombay Nat. Hist. Society.

The skins do not agree with the type described by Pucheran in the absence of the chest-patch, although in one of them it is very small, only an inch or two wide, and much smaller than in any Indian skin; but in the other it is quite conspicuous and as large as in some Indian skins. But in both of them the coat which shows no obvious signs of moult is much shorter and less shaggy than in the skins from Bengal and central India recorded above. At a little distance the skins resemble much more closely skins of *Selenarctos thibetanus*, especially short coated skins of the latter in which the lateral crest on the neck is differentiated from the nape. In the Uva skins the hair on this crest and on the dorsal mat is between 3 and 3½ ins., on the nape it is barely 1 in., and on the rump from 1 to 1½ ins.

The Museum has a large series of skulls of the Sloth Bear. Unfortunately very few are sexed. In the following table are given the measurements of two ♂ and one ♀ in which the sex was recorded and of one or two others selected for their size, distribution or some other feature. A comparison of the tooth measurements with those of the races of *Ursus arctos*, in the first part of this paper, clearly shows their great differences in size in the two species.

	Skull in English inches,						Upper teeth in millim.		Lower teeth in millim.	
Locality and Sex	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
M. u. ursinus										
Belaghat, C.P.	13·6	12·8	8·7	6·5	3·2	3·2	...	...	...	...
Melghat, C.P.	13·1	12·2	8·0	5·9	3·1	3·0	47	20×12	56	15×10
S. Chanda, C.P. ♂	12·9	12·2	7·5	5·8	3·1	3·0	50	21×12	58	16×11
,, ,, ,, ♂	12·3	11·6	7·6	5·7	2·7	2·9	49	19×10½	57	15×10
Bankura, Bengal. ♀	11·6	11·4	6·8	5·2	2·6	2·6	45	20×11	54	15×10
Gauripur, Assam.	12·9	...	8·1	...	3·1	3·1	50	20×11	57	15×10
S.-E. Coorg.	13·1	12·2	8·0	6·1	2·9	3·0	50	20×12	58	16×11
M. u. inornatus										
Uva, Ceylon. (young) ♂	10·9	10·4	6·7	4·9	2·5	2·5	48	18×10	54	15×10
S. Ceylon. (young)	10·2	9·7	...	...	...	...	47	19×11	54	16×10

The first skull on this list, presented to the British Museum by Sir Richard Dane, is interesting on account of its size. It is easily the 'record' for the Sloth Bear, judging from Rowland

Ward's *Records of Big Game*, 1928, where (p. 504) four skulls are entered ranging from 12½ to 12⅞ ins. in total length and from 6¾ to 7 ins. across the zygomata. These are all narrower and, with one exception, shorter than the male or supposedly male skulls enlisted above. Although unsexed, Sir Richard Dane's skull is no doubt that of a male. It is quite old with a highly domed cranium and had lost many of its teeth, but not all, before death. The skull from Melghat, presented by Mr. Dunbar Brander, is fully adult. Of the two from S. Chanda, presented by Capt. C. R. S. Pitman, both are oldish with worn teeth; but the smaller is the older of the two. The female skull from the 'Salt Jungle', Bankura, presented by Mrs. McGregor, is old with the teeth much worn. The skull from Gauripur, no doubt that of a male, was kindly presented by H. H. the Maharajah of Gauripur in response to my appeal for specimens published in this Journal. It is interesting from two points of view. Its locality to the north of the Ganges is nearer than any, whence I have seen specimens,

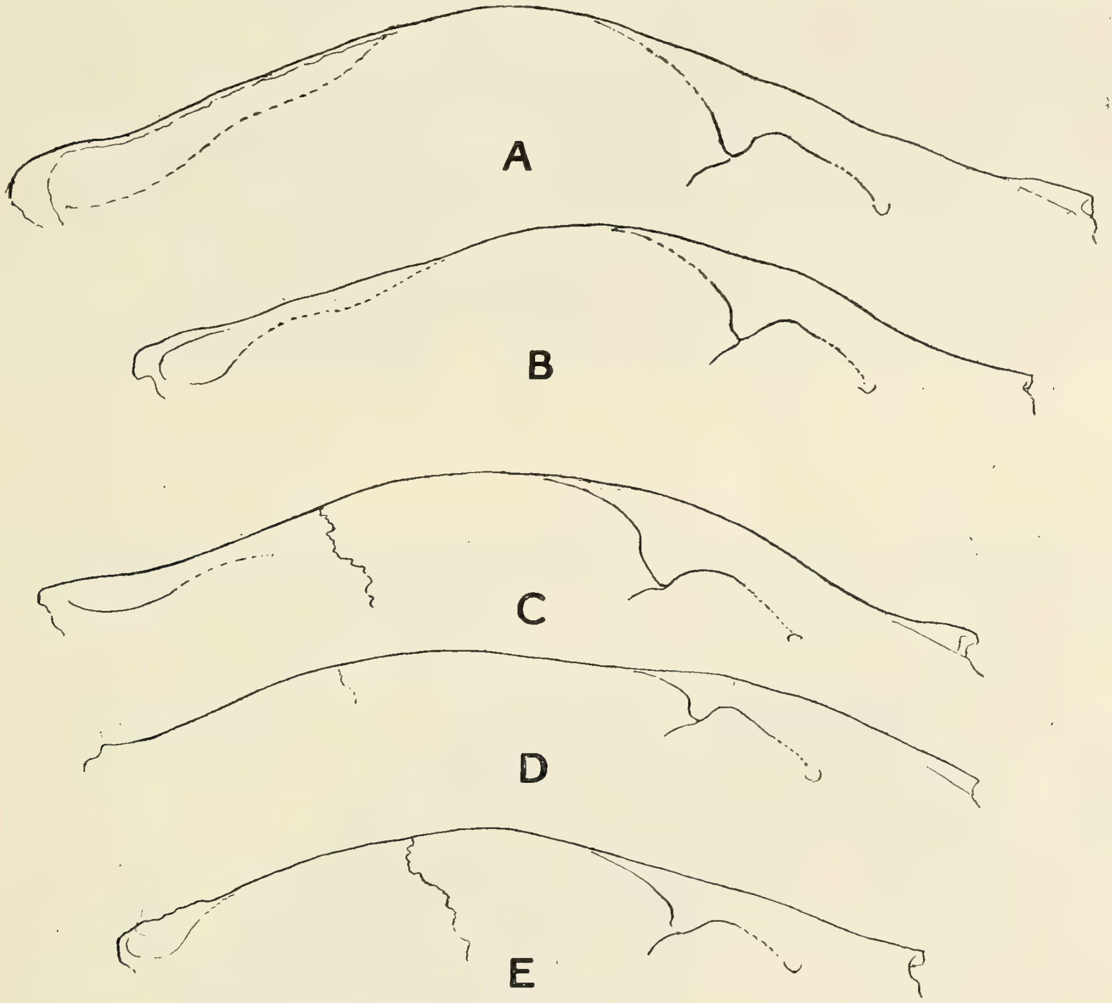


Fig. 3

A. Upper profile of skull of old male Sloth Bear (*Melursus ursinus*) from Balaghat, C.P.
B. The same of an old female from Bankura, Bengal.
C. The same of an adult male Black Bear (*Selenarctos thibetanus*) from Vekohoni, Naga Hills.
D. The same of an older male from Liramon, Naga Hills.
E. The same of an adult female from Mokokchung, Naga Hills.

to the typical locality of *Melursus ursinus.* Also it is the only specimen I have examined from Assam. True Gauripur is west of the Brahmaputra in the valley of that river which traverses the 'plains of Assam'. When Blanford stated that he was unable to ascertain whether the bear reported from these plains was this species or the so-called Himalayan Black Bear, he must have overlooked Cuvier's record of it from Sylhet, showing that its range is to the east and south of the Brahmaputra.

By way of comparison with this skull from Assam I have given the measurements of one, also no doubt a male, collected by G. C. Shortridge for the 'Mammal Survey' at Nagarhole in S.-E. Coorg, some 1,400 miles from Gauripur. The dimensions agree very closely. No skin accompanied the Coorg skull and it is not unlikely that the South Indian Sloth Bear will prove inseparable from the Ceylonese for which I have retained the racial name *inornatus.* Of this bear I have only seen two immature skulls. Since their teeth are quite unworn, it is possible that the Ceylon bear may prove to have smaller teeth on the average than the Indian; but no definite conclusions can be drawn from the two examples.

GENUS: SELENARCTOS, Heude.

Selenarctos, Heude, *Mém. Hist. Nat. Emp. Chin.*, v, p. 2, 1901; Sowerby, *Journ. Mamm.*, i, p. 216, 1920.

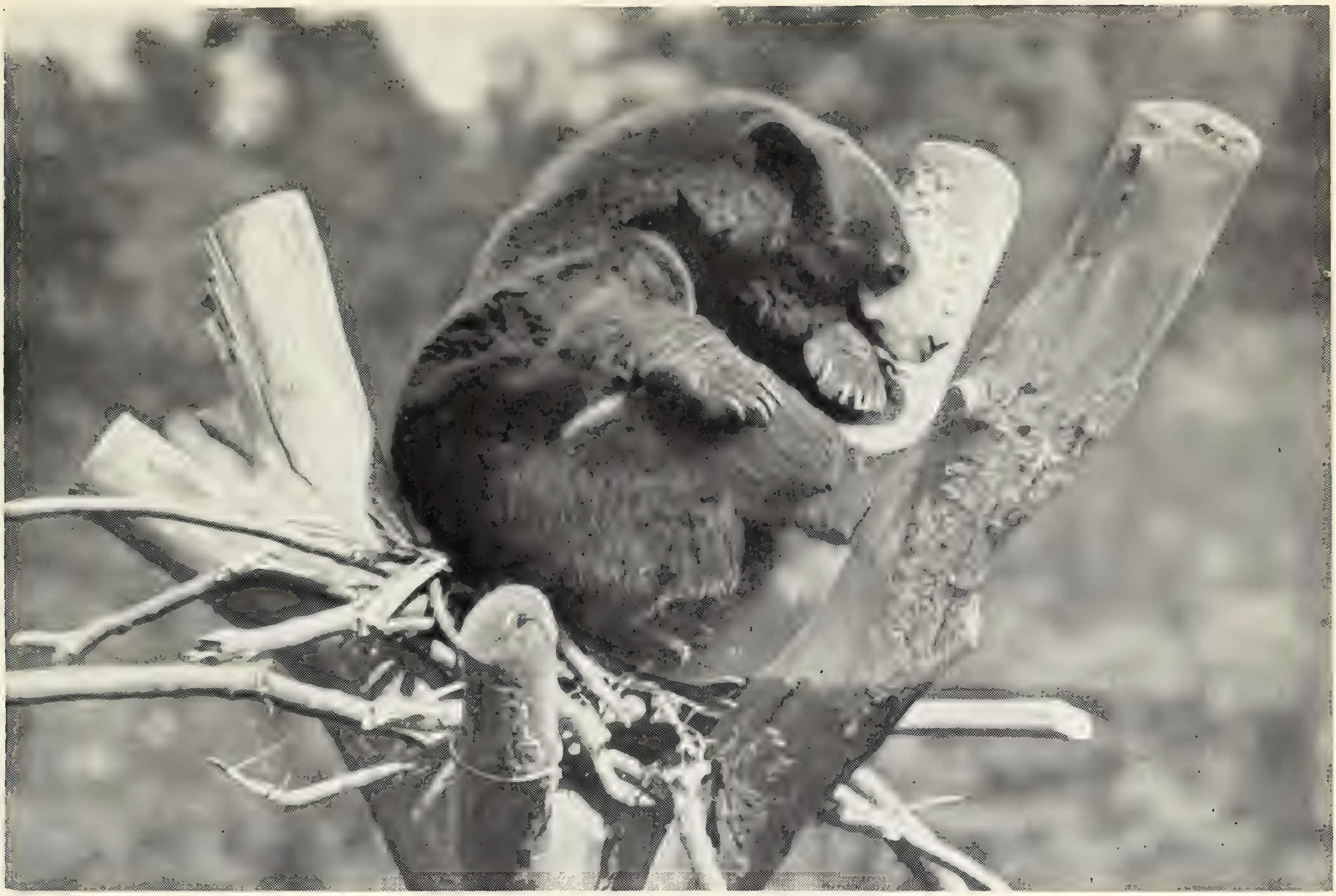
Arcticonus, Pocock, *Ann. Mag. Nat. Hist.* (8), xx, p. 129, 1917.

Distribution.—From Baluchistan, through the Himalayas eastward to Burma and Annam and northwards through Central China to Amurland and possibly Kamschatka.

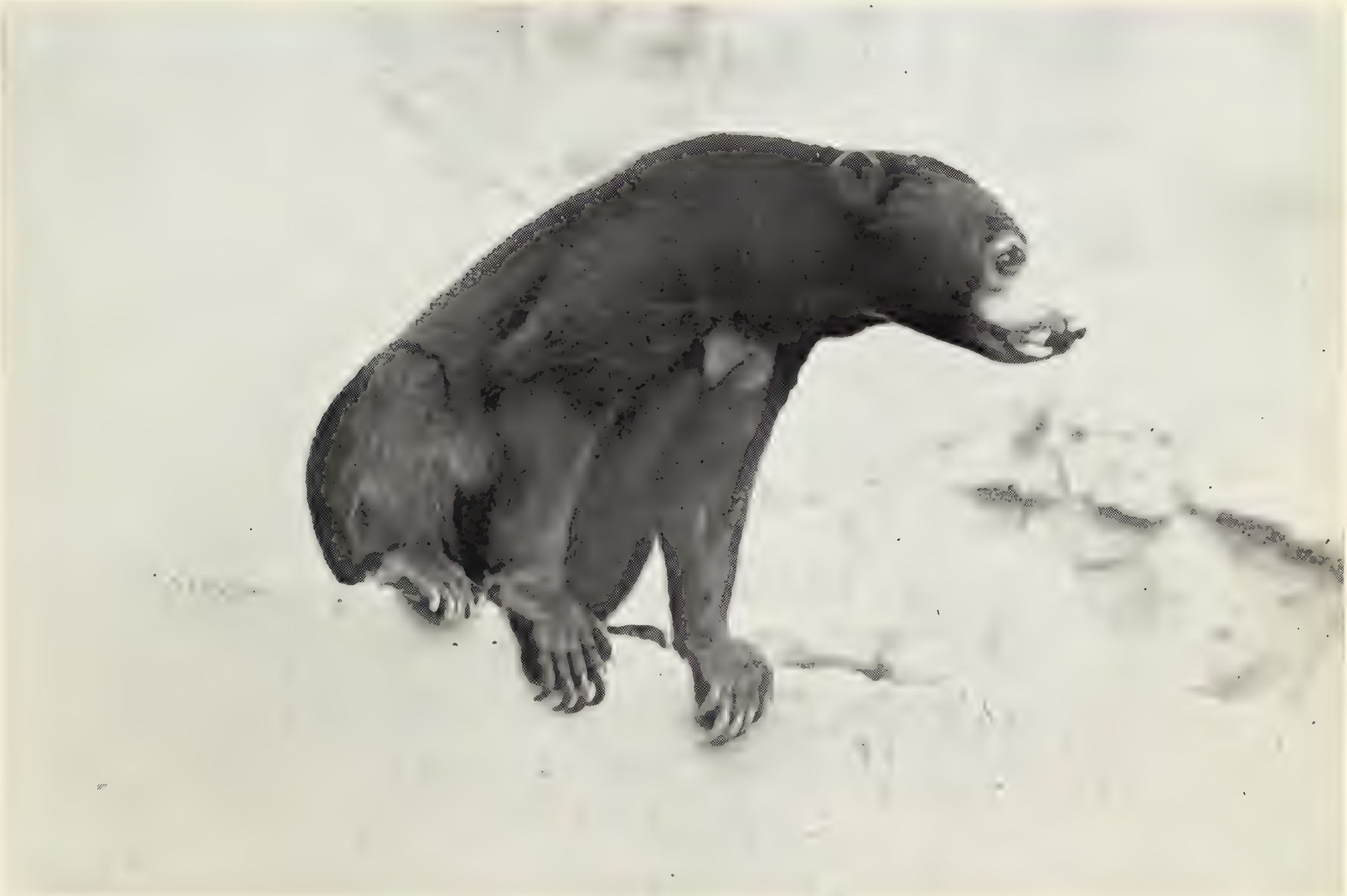
Note on the generic synonymy.—When I proposed the name *Arcticonus* for the Himalayan Black Bear (*Ursus thibetanus*) in 1917, separating it from *Ursus* on the evidence supplied by the fore paw, I was unaware that Heude had applied *Selenarctos* to the same species, my excuse for the oversight, pointed out by Sowerby, being the omission of the name from the *Zoological Record.*

Description of the genus.—Closely resembling *Ursus* in the rhinarium, lips and ears, but differing essentially in the structure of the fore foot which has the area behind the plantar pad entirely naked and mostly occupied by a single large, transversely piriform pad as wide as the plantar pad and as long as it internally, but shorter externally where it narrows considerably and may be in contact with the plantar pad. This pad represents the larger and smaller carpal pads, surrounded by hair, seen in *Ursus.* The area between it and the plantar pad is occupied by a comparatively narrow area of naked, flexible, creased skin.

In the skull the muzzle is shorter than in *Ursus;* and this is associated with a backward extension of the cheek teeth so that a vertical tangent from the anterior rim of the orbit passes in the adult in front of the contact line between the two upper molars and never behind it as in *Ursus.* The cusps and ridges of the



Black Bear (*Selenarctos thibetanus*)



Malayan Bear (*Helarctos malayanus*)

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main cheek-teeth are lower and less trenchent, the areas between them are smoother and the first lower molar, the antepenultimate tooth, has a relatively smaller 'heel' than in *Ursus*. (See fig. 3, p. 775 of the first part of this paper).

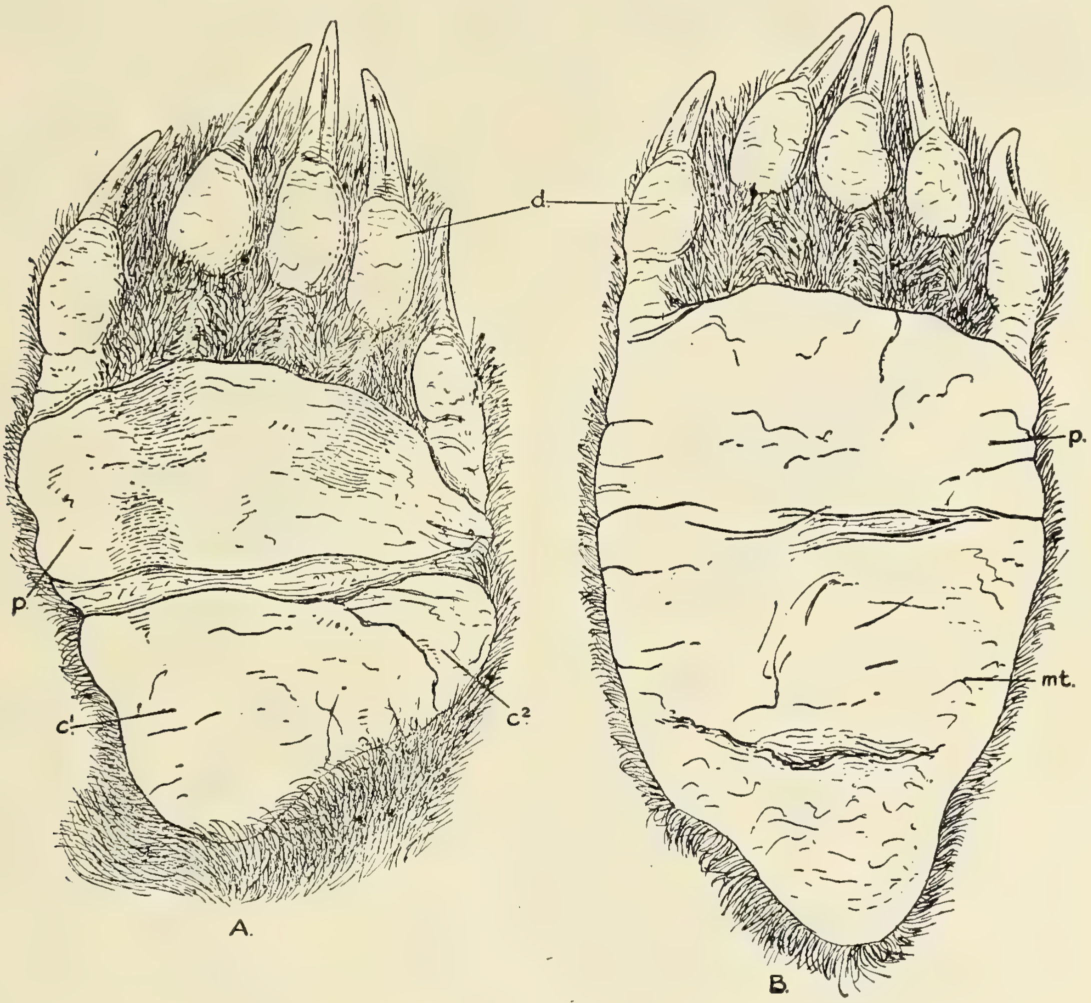

Fig. 4.

A. Lower side of right fore paw of the Black Bear (*Selenarctos thibetanus*). B. Right hind paw of the same. Lettering as in fig. 1.

Apart from the feet this bear differs externally from *Ursus* in its more massive neck, in the absence of the shoulder mat and in the presence on the side of the neck of a crest, very noticeable in short coated specimens, formed by the confluence of the downward stream of hairs from the nape and the upward stream from the throat.[1]

The Bears of this genus, referred to the species *S. thibetanus*, are usually designated Asiatic Black Bears; but the existence in Manchuria and Japan of black bears of the *Ursus arctos*-group, commonly called Brown Bears, deprives those titles of their significance. The occurrence of 'brown' specimens of *S. thibetanus* has also been claimed; and its possibility must be borne in mind. In my experience the general colour of the perfect coat is almost always jet black, relieved by a brown muzzle, still paler lips and chin, a pale chest-mark and frequently some dark brown on the paws, especially laterally, and on the toes. Occasionally specimens exhibit patches of white, or white hairs attesting incipient albinism.

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[1] Blanford's statements that there is no 'woolly underfur', that the chin and the chest-mark are white and that the claws are black is by no means always true even of Indian specimens.

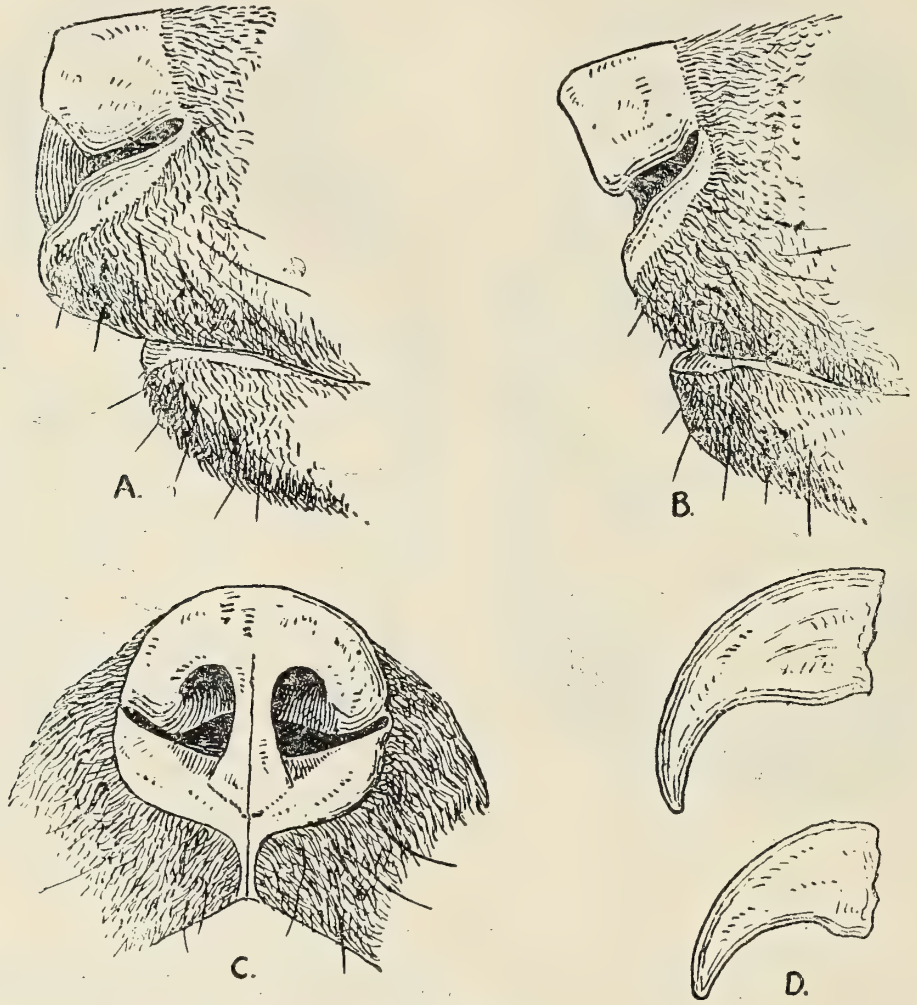

Fig. 5.

A. & B. End of the muzzle of two examples of the Black Bear (S. *thibetanus*), showing difference in the shape of the rhinarium.
C. Rhinarium of the same from the front.
D. Claws of fore and hind foot of the same.

An historic case of a 'brown' specimen is supplied by the skin from the Mekran coast described in 1877 as *Ursus gedrosianus* by Blanford who originally regarded it as a representative of the *Ursus arctos*-group. The possibility of the correctness of that view was briefly discussed in the first part of this paper. Nevertheless Blanford changed his opinion two years later when he received a second skin, and two skulls, from the same district. This skin was very much darker than the first, evidently dark brown, but, as Blanford said, 'far from being black' like the Himalayan Black Bear, the species to which Blanford declared the two skulls to belong. This Baluchistan bear is further discussed below (p. 116).

For another record of similar variation in colour I am indebted to Col. C. H. Stockley who informed me (*in litt.*) that in Oct. 1919 he shot, right and left, a male 'red' bear and a female 'black' bear, on the eastern side of the Shanshibir Mountains at the western end of the Kashmir Valley. In 1928 he presented to the British Museum the alleged skull of the 'red' bear. It is unmistakably the skull of *S. thibetanus* and is entered in the table of measurements given below (p. 118). If the skull belonged to the skin, as stated, proof that the Himalayan black bear may have a 'brown' phase is supplied.[1] But collectors' skins and skulls sometimes get mixed; and the skull in question may have belonged to the black female. It is the skull of an old animal and is decidedly small for a full grown male skull of *S. thibetanus* from Kashmir. That the Himalayan 'Red or Isabelline' Bear (*U. arctos isabellinus*) and the Himalayan Black Bear (*S. thibetanus*) sometimes occur together is known from the evidence of sportsmen. In the first part of this paper I referred to a case recorded by Mr. H. Whistler in the Solang Nullah, Kulu.

SELENARCTOS THIBETANUS THIBETANUS, G. CUV.

Ursus thibetanus, G. Cuvier, *Ossemens Foss.* iv, p. 325, 1823.

Ursus tibetanus, F. Cuvier, *Hist. Nat. Mamm.*, ii, pt. 39, p. 3, 1824; and iii, pt. 41, pl. 1824; and of many later authors.

Ursus torquatus, Wagner in *Schreb, Säug.*, Suppl. ii, p. 144, 1841; and of many subsequent authors including Blanford, *Fauna of Brit. India: Mammalia*, p. 197, 1888. (Name substituted for *thibetanus*.)

? *Selenarctos melli*, Matschie, *Arch. Naturg.* 88, pt. 10, pp. 16 and 34, 1922; G. M. Allen, *Amer. Mus. Novit.*, No. 360, p. 3, 1929 (as subspecies of *S. thibetanus*).

Locality of type of *thibetanus*, (including *torquatus*): Sylhet in Assam.

Locality of type of *melli*: Kwangtung, S. China.

Distribution.—Assam westwards apparently to the Nepal Tarai and eastwards through Burma to Siam, Annam and possibly Southern China.

Notes on the synonymy.—I take Sylhet as the typical locality of this race because G. Cuvier gave the name *thibetanus* to a bear from that district of which Duvaucel sent him a description. This description Cuvier printed in full, definitely associating the name with Duvaucel's account, although on Wallich's authority he referred to the occurrence of what he supposed to be the same bear in Nepal. F. Cuvier also reproduced Duvaucel's account in the same year, spelling the name *tibetanus;* but since he stated that his brother had named the species, G. Cuvier must be given the credit for it and his spelling of the name adopted. The name

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[1] It is regrettable to reflect that a glance at the fore paws of this 'red' skin and of the two Baluchistan skins described by Blanford would have settled their identity beyond dispute. Unfortunately the skins are not now available for examination.

torquatus was proposed by Wagner as a substitute for *thibetanus* because there was at that time no evidence of the existence of the species in Tibet. Blanford and Lydekker followed Wagner's nomenclature and by one or the other of the two names the species has been cited by all authors. During recent years zoologists have quoted it as *Selenarctos thibetanus*.

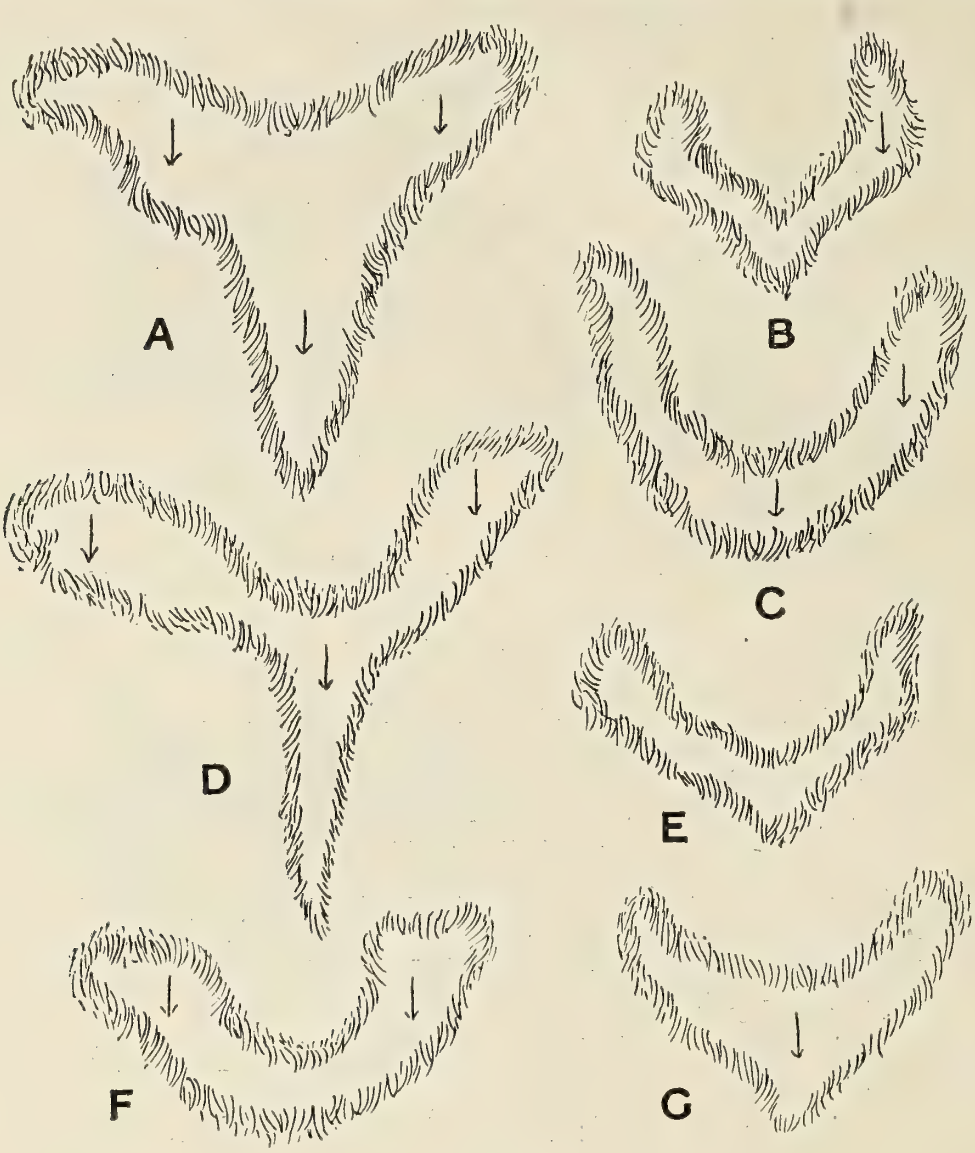

FIG. 6.

The Breast-patch or collar of Black Bear (*S. thibetanus*). A. example from Okotso, Naga Hills; B. from Wokha, Naga Hills; C. from Nepal; D. from Sikhim; E. from the Upper Lidder Valley, Kashmir (type of *laniger*); F. from Szechuen (*mupinensis*); G. from Formosa (*formosanus*).

The arrows show the direction of the hair-growth.

Selenarctos melli, Matschie, is regarded as a possible synonym of *thibetanus* for reasons given below.

Description.—This typical race of *S. thibetanus* may be distinguished from the more northern races by its comparatively short, coarse, coat without underwool. Very few of the skins I have seen are dated; but this type of pelage is found in one from Okotso in the Naga Hills, killed in October, and in another from Manipur dated February 2. The coat should be at its best in February and good in October.

The breast mark or 'collar' varies greatly in colour and development (see fig. 6, p. 112). The muzzle also varies in tint. Typically it is brown, but it may be greyish, tan, very dark brown or, according to Duvaucel, black.

The following notes on the skins in the British Museum I assign to this race may be interesting.

Three from the Naga Hills, Assam, collected for the Mammal Survey by J. P. Mills:

1. Wokha, ♂. Colour jet black, with the muzzle dark brown (chin cut away). Collar cream-buff, a wide-spread V, the arms about 11 inches long and 2 ins. wide, meeting at a point and not extending along the middle line of the breast. Coat shortish without underwool, about 1½ ins. long, very scanty on belly, but 2½ to 3 ins. on the crest on the sides of the neck.

2. Okotso, ♂. Skin dated Oct. 1919. Like the last in length of coat but the hairs lustreless and coarser. Some white on the chin. Collar ochraceous, very large, wide and long, Y-shaped, extending over 6 ins. along the middle line of the sternum and nearly 7 ins. laterally in front of shoulder, apparently resembling in its extent that of the type from Sylhet.

3. Mokokchung, ♂. Jet black but dull, with some brown hair on paws. Muzzle decidedly paler than in others, greyish brown. Chin brown. Collar buffy-brown, large, V-shaped, each arm about 11 ins. long. Coat coarse, scanty, without underwool, but a little longer than in Nos. 1 and 2, being from about 1½ to 2½ ins. on body, and 3½ ins. on the neck-crest.

Although Mills only sent these three skins, he inscribed on the labels attached to some of the skulls a few particulars worth recording. One from Lakhuni, 1,500 ft. had the fur short and coarse; the collar narrow and yellow. One from Aré, 3,000 ft., October 1919, had longish sparse hair and a narrow yellowish collar. One from Aichisigami, 3,000 ft., August 1921, had the hair short and thin and the collar white.

4 & 5. Two skins in Hodgson's collection probably from the Nepal Terai. One ticketed 'India' has the muzzle and chin brown, the collar yellowish brown, V-shaped, the arms about 13 ins.; the coat is quite short and coarse, without underwool. The other, unlocalised, has the muzzle brown; the chin with a small white patch; the collar creamy-white, V-shaped, its arms about 11 ins.; the coat coarse and short, without underwool, about 1½ to 2 ins., but from 3½ to 4 ins. on the neck crest.

6. Manipur. A flat skin, no doubt of an adult ♂, dated February 2nd, 1920, kindly lent to me by the Bombay Natural History Society. The muzzle is dark brown, the chin dirty white. The collar is V-shaped and very narrow, the arms being 10 ins. long but less than 1 in. wide. The coat is short and coarse, without underwool, and about 1½ ins. long; the hairs of the neck-crest being nearly 4 ins. The skin, perhaps stretched, measures 6 ft. 2 ins. to the tail-root.

7. Hué in Annam. A flat skin brought back by Messrs. Delacour and Lowe. The muzzle, towards the nose, and the chin are tan or buff. The collar, of the same tint, is a long narrow V,

the arm about 11½ ins. long and 1 in. wide. The coat is coarse, without underwool, and short, about 1½ ins. long, but 3 ins. low down on the flanks and 3 ins. on the neck-crest.

This skin from Annam is indistinguishable from those from Manipur and the Naga Hills. It is from the evidence it supplies that I infer the southern Chinese bear described as *melli* by Matschie may be the same as typical *thibetanus*.

This paragraph, discarding *melli*, was written before I had seen the remarks on *melli* published by G. M. Allen who, on the evidence of the skin and skull of an old male from Fokien, accepted *melli* as a subspecies, differing at all events from the more northern Chinese bears in being smaller and shorter coated. The skull, he says, is about the size of an adult ♀ skull from Shensi. But since no measurements were given to help me form an opinion regarding *melli*, I have let this name interrogatively remain in the synonymy of *thibetanus*, although there is some evidence that it should come under *formosanus* (see below).

The following three skins are of doubtful subspecific status:—

At Duragiri, 3,000 ft., in the Garo Hills, H. W. Wells secured on March 16th a very interesting little specimen. It is a female cub, 2½ ft. long, with a comparatively long and thick coat, provided with underwool. The colour is black with the muzzle brown and the head speckled with shining grey hairs as far back as the ears. The collar is white, triangular posteriorly with two narrow divergent arms. There is an angular whitish patch on the chin and some dirty white hairs on the under side of the paws behind the digital pads. The hair of the body is from 2 to 2½ ins. long, on the sides of the neck 3 ins.

In the thickness of its coat this specimen recalls the Kashmir race described below. The partial albinism of the paws is of interest in connection with the specimen of the western Chinese race which was named *leuconyx*, as described below. The grizzling of the face is no doubt another sign of incipient albinism.

From Sikkim I have seen two skins. One, collected by Mandelli and presented to the Museum by Blanford. The coat is thicker than in the skins from Nepal and Assam I have examined but has no appreciable underwool; it is of medium length, about 1½ to 2 ins. on the body and from 4½ to 5 ins. on the sides of the neck. The muzzle is brown, not dark, above, tan at the sides, the chin is white and the collar, about 13 or 14 ins. from point to point, very narrow and passing a long way back over the sternum, is buffy white.

The second, a cub 2 ft. 9 ins. long, from Lachung, 9,000 ft. (C. H. Dracott), kindly lent to me by the Bombay Natural History Society, has the coat long, thick and soft with a good deal of brown underwool, the hair on the sides of the neck being 3.2 ins., on the back 2.1 ins., on the flanks 3 ins. The muzzle is brown, but not dark, the whole of the chin is buff black to the corners of the mouth, the buff extending to a point along the fore part of the throat; the collar is the same tint, broad and Y-shaped, the posterior branch shorter than the arms; the paws are brown along the margins and round the digital pads. In the quality and length of its fur and in its well developed underwool, this skin closely approaches the races from Kashmir and Szechuen and perhaps belongs to the latter. It certainly differs from typical short-coated Assamese examples of *S. thibetanus*.

SELENARCTOS THIBETANUS LANIGER, subsp. nov.

? *Ursus torquatus* var. *arboreus*, Gray, *Proc. Zool. Soc.*, 1864, p. 688; *id. Cat. Carn. B.M.*, p. 226, 1869.

Locality of type of *laniger*.—Aru, the Upper Lidder Valley, Kashmir.
Locality of type of *arboreus*.—Darjiling.
Distribution.—Kashmir and probably at relatively high elevations elsewhere in the Himalayas.

Distinguishable from the typical form, represented by the Assamese skins, by its longer, softer and altogether more luxuriant coat which carries a very appreciable quantity of underwool, especially on the neck in winter.

I have seen five skins from Kashmir which I assign to this race:

1. The flat skin of a female (*type*) from Aru in the upper Lidder Valley shot in May by Capt. H. A. F. Magrath (No. 97, 5, 6, 1.). Colour jet black, glossy; muzzle dark brown above, paler at the sides; chin white; collar white, small, V-shaped, the arms about 4 ins. long. Coat long and luxuriant; hair on sides of neck about 4.8 ins., on back 2½ ins., on flanks 3¼ ins. Length of skin 5 ft. 7 ins.

This skin, although obtained in May, is in perfect condition, the coat showing no sign of deterioration or of approaching the moult as in the Red Bear at the same time of the year.

2. Flat skin of a subadult male from Shalkood (Mrs. Entwistle, Nos. 25, 1, 3, 1.). Closely resembling the last in every respect, although the collar is larger, the arms of the V measuring 7 ins. Hair on sides of neck 5 ins., on back 2½ ins., on flanks 3¾ ins. Length of skin 5 ft. 10 ins.

3. Flat skin of young male shot on Oct. 23rd, 1930, at Milawan, Pir Panjal, 8,000 ft. (Col. C. H. Stockley). Colour black, with chin and collar white, the collar small about 6 ins. only transversely from point to point and ½ in. wide. Coat thick, with underwool, the hairs 4½ ins. long on sides of neck, 3¼ on the nape and 2 ins. on the back.

This skin has a much longer and thicker coat than the one of typical *thibetanus* referred to above from Okotso in the Naga Hills, which was also shot in October.

4 & 5. Two skins, one certainly ♂ judging from the skull, and the other probably the same sex judging from its size, there being no skull to it, shot at Dachigam by Sir Richard Dane, K.C.I.E., late in November, have the coat noticeably shorter, thinner and less luxuriant than the Nos. 1 and 2, but some underwool is detectable, although comparatively scanty, at least on parts

of the fore quarters and neck. The muzzle is rich brownish or rufous tan, brighter than in the other specimens but, as in them, the chin and breast-mark are white, the latter also being small. The skin, which has the skull, measures 6 ft. 7 ins. The hair on the neck-crest is 4½ ins., on the back and upper flanks 2 ins., low down on the flank 3½ ins. or more. The paws are edged with dark brown hairs. The other skin, measuring 6 ft. 2 ins., is slightly shorter coated, the hair on the neck-crest being 3¾ ins., on the back and flanks from 1½ to 2 ins. It has a decidedly brownish tinge on the belly, the back of the fore legs, on the edges of paws and to a certain extent on the rump.

It may be worth remembering that in all Kashmir skins the chin and breast-mark, or 'collar', are white, and the collar is small. In Assamese specimens, and the skins associated with them, the chin and 'collar' are more often than not tinged with buff or ochre and the collar is on the average larger.

This race of *S. thibetanus* is probably rather 'environmental' than 'local'. It is linked with the typical race found at lower levels in Assam by the Sikkim specimens recorded above; and it is probable that wherever *S. thibetanus* occurs at tolerably high altitudes in the Himalayas and elsewhere it acquires a longer coat with underwool, especially in winter. Even in Assam it may grow this type of coat as attested by the cub, above referred to, secured by H. W. Wells in the Garo Hills.

SELENARCTOS THIBETANUS GEDROSIANUS, Blanf.

Ursus gedrosianus, Blanford, *Proc. As. Soc. Bengal*, 1877, p. 204; and *Journ. As. Soc. Bengal*, 46, p. 317, 1877; id. *Proc. As. Soc. Bengal*, 1879, p. 4.

Ursus torquatus, Blanford, *Mamm. Brit. India*, p. 197, 1888.

Locality of type.—Tump, 70 miles N. of Gwadar on the Mekran coast, Baluchistan.

Distribution.—Baluchistan.

I provisionally adopt *gedrosianus* in a subspecific sense for the two 'brown' skins and the two skulls from Tump in Baluchistan to which Blanford gave that name; and in following this course I am compelled to assume, since all the specimens have disappeared, that Blanford knew the difference between the skulls of *Ursus* and *Selenarctos* and that the larger of the two skulls he referred to belonged to the dark brown skin received with it.

The story of the skins already briefly told may be completed by the remark that in 1888 Blanford added *gedrosianus* to the synonymy of *thibetanus* (*torquatus* he called it), stating that he had been deceived by a 'discoloured' skin into thinking that it represented a valid species. He thus apparently cancelled the opinion he expressed in 1879 that *gedrosianus* was to be regarded as 'little more than a race or subspecies' of the Himalayan Black Bear. Presumably Blanford's verdict regarding the 'discoloration' applied to the imperfect skin of the type which was 'dark rufous brown'. But the second skin although 'very much darker than the first' was expressly stated to be 'far from black' like the Himalayan Black Bear.

Blanford's description of the typical skin as having a white spot on the chin and a narrow white semicircular collar, not produced in front of the shoulder, supports his view that the bear was a *Selenarctos;* but the muzzle was whitish. The coat was harsh, thin and short, 1½ ins. on the body and 2½ ins. on the shoulder.

The skull received with the second skin was declared to be scarcely distinguishable from that of a female Indian Black Bear from Alipore. The dimensions Blanford supplied, which are quoted in the table below, bear out this statement. But a second skull, said to be that of a fully adult animal, he dismissed, without detailed measurements, as 'very much smaller than any full grown skull' of the Himalayan Black Bear. Naturally, and probably rightly, he concluded these skulls to be ♂ and ♀ of the same race.

When I wrote to the Museum at Calcutta to inquire for Blanford's specimens of *gedrosianus,* I was informed that they are not in the Collection; but Lt.-Col. Seymour Sewell, the Director, kindly sent me three skulls from Baluchistan, two being adult, the third immature and fragmentary. The two adult skulls are smaller than any adult skulls of *S. thibetanus* from India that I have seen. They are unsexed and I regard them as probably ♀ skulls of *gedrosianus.* The smaller of the two is the older and has a longer occipital crest. They differ a good deal in the size of their teeth; but the cub has the teeth, which are quite unworn, larger than in either of the adults. There is, however, nothing in the size of the teeth of the three to distinguish them from those of Indian specimens; and the differences between the teeth of the cub and those of the adult with the smallest teeth is less than the difference between the teeth of the immature ♂ from Nepal and the old ♀ from Khatmandu entered in my table below.

On the evidence furnished by the particulars quoted this provisionally admitted race may be defined as a little smaller than the eastern forms, with the coat apparently as in the typical race but very dark brown or rufous brown in hue[1] at least in the Mekran coast examples.

The arid environment of these bears, as Blanford pointed out, is very different from the woodland habitat of Himalayan specimens.

Skulls.—The following are the measurements of the skulls of the three races of the Black Bear inhabiting British India described above.

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[1] The only representative of *Selenarctos* from Baluchistan that I have seen was exhibited many years ago in the Zoological Gardens. It was jet black and indistinguishable from ordinary Indian specimens, except that it was smaller.

	Skull in English Inches						Upper teeth in millim.		Lower teeth in millim.	
Locality and Sex	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 teeth	Last tooth	Last 4 teeth	Penult. tooth
gedrosianus										
Mekran coast ?♂	10·5	...	6·9	...	2·9	2·6	...	...	...	...
Baluchistan ?♀	9·5	...	5·9	4·7	2·3+	2·2	58	27×16	65	20×11
,, ?♀	9·1	8·7	5·8	4·5	2·2	2+	55	25×14	61	19×11
,, cub	...	7·3	...	...	...	...	59	29×16	71	22×13
laniger (Kashmir)										
Murree ♂	12·0	11·1	8·1	6·4	3·4	2·7	58	29×16	...	...
Kashmir ♂	11·5	10·7	7·9	6·3	3·2	2·7	61	28×16	70	21×12
Pir Panjal, 7,500 ft. ♂	11·5	10·5	7·4	5·8	2·8	2·5	57	27×15	63	20×12
Shalkood ♂	10·9	10·8	7·2	5·4	2·8	2·5	63	30×17	72	22×13
Shamshibir mt. ?♂	10·5	10·2	6·7	5·5	2·8	2·4	56	28×16	62	19×12
Pir Panjal, 8,000 ft. ♀	10·1	9·6	6·3	5·1	2·3	2·1	54	26×15	61	19×11
Upper Lidder Valley ♀	9·8	...	6·7	5·0	2·7	2·3	53	26×15	66	19×11
Dehra, 9,000 ft. ♂	12·2	11·1	7·5	6·0	2·9	2·5	55	25×14	60	17½×12
,, ,, ♀	10·9	10·5	7·1	5·5	2·6	2·5	56	27×16	64	19×11
Nepal ♂	12·0	11·3	6·6	5·8	2·8	2·6	65	30×17	72	22×14
,, ♂	11·3	10·7	6·9	5·6	3·0	2·5	56	26×15	64	18×11
Khatmandu ♀	10·7	10·0	5·9	5·5	2·7	2·3	52	24×14	58	17×10
thibetanus (Assam)										
Aichisigami, ♂	12·1+	...	7·8	6·5	3·0	2·6	60	28×15	67	20×11
Liramon ♂	11·1	...	6·9	...	2·7	2·6	56	26×15	64	20×11
Lakhuni ♂	...	...	7·5	...	2·9	2·6	51	23×13	...	18×11
Nungumshang ♂	10	...	5·5	...	2·3	2·4	66	31×17	73	22×13
Mokokchung ♀	10·3	9·6	6·9	5·6	3·1	2·5	52	25×14	64	20×10
Mongsendi ♀	10·0	...	6·2	...	2·4	2·2	52	23×13	58	18×11
Tonghoo ?♂	11·6	...	7·1	6·1	2·8	2·5	56	25×15	64	18×11
Nr. Um Pang, Siam?	10·5	...	6·2	5·1	2·6	2·4	59	28×15	67	20×12

The skulls entered under *gedrosianus* at the head of this table have already been discussed above under that provisionally admitted race. It may be recalled that the skulls queried as ♂ and ♀ are adult. Sex for sex they are noticeably smaller than adult skulls of the two Indian races *thibetanus* and *laniger*.

The skulls assigned to typical *thibetanus* from Assam were collected for the Mammal Survey of British India by J. P. Mills. They vary greatly in shape, no two of either sex being quite alike. In text-fig. 3, C, D, (p. 107) the dorsal profile of two adult ♂ skulls from Vekohoni and Liramon, 2,500 ft., are sketched to show the difference in the elevation of the summit and in the shape of the dorsal profile of the muzzle. Both have the teeth somewhat worn; but the example from Vekohoni with the strongly convex profile is the younger of the two. On the average most of the other male skulls intergrade between these two. A skull from Wokha is old; but although the teeth are much worn, they are nearly as large as in the specimen from Nungkungshang, 4,700 ft., entered to show the size of the unworn teeth, which are very much larger than in the Lakhuni skull, whose teeth are worn, but not so much as in the example from Wokha. The first male skull on the list from Aichisigami, 4,000 ft., on the Dikhur River, is a large skull, but it is quite young with the open cranial sutures indicating that growth had not ceased. The teeth, however, are a good deal worn. Female skulls vary similarly. The most arched of the series is a very old, broad-muzzled skull from Mokokchung, which is also figured. The teeth are much worn, more worn but larger than in the younger but oldish specimen from Mongsendi.

The young skull, probably ♂, from Tonghoo in Burma (*E. W. Oates*) is practically indistinguishable from the Assamese series. So too is a younger skull from the Meklong Valley, 3 miles S.-E. of Um Pang in Siam (C. H. Stockley). The teeth are noticeably larger than in the Tonghoo skull, although in neither are they worn.

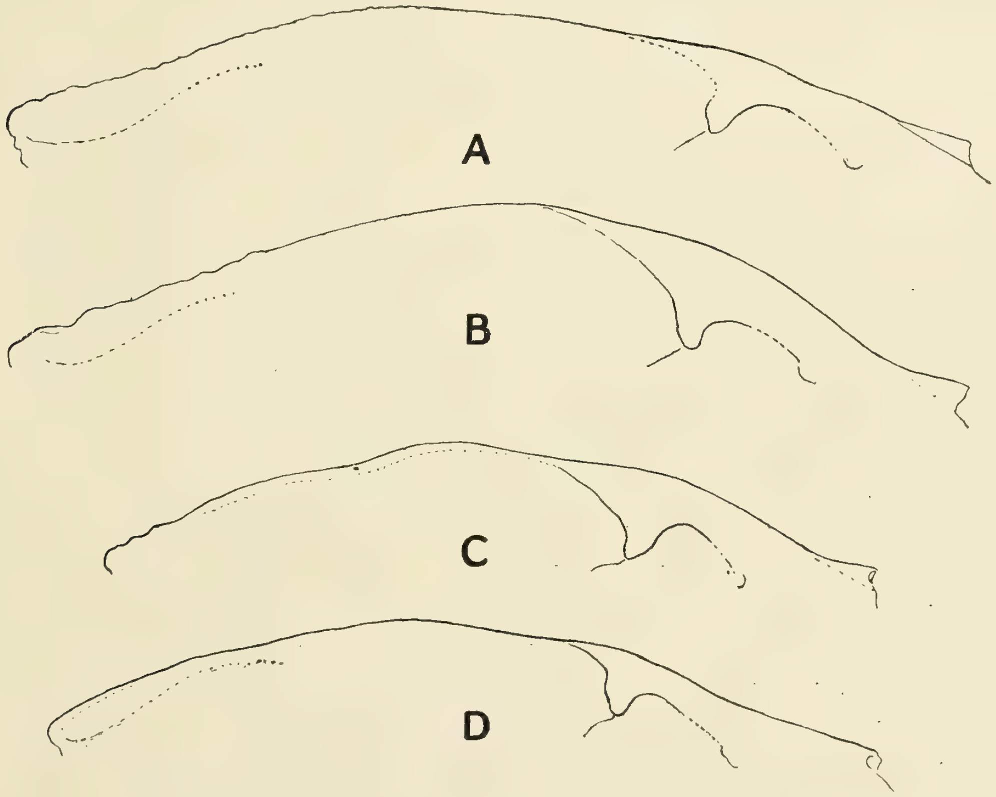

Fig. 7.

A. Upper profile of oldish male Black Bear (*S. thibetanus*) from Jaunsar, Dehra Dun.
B. The same of very old male from Dunga Gali, Murree.
C. The same of old female (type of *laniger*) from the Upper Lidder Valley, Kashmir.
D. The same of the reputed red male of *laniger* from the Shanshibir Mountains, Kashmir,

There is a good number of Hodgson's Nepalese skulls in the British Museum, all unsexed and not one quite fully developed, most being cubs. Naturally they are not so variable as the Assamese set, from which I cannot distinguish them, and are rather of the 'flat' than the vaulted type. Of the three entered in the table the first two are probably ♂. The upper cranial sutures, including the interparietal, are unfused in both; and the basioccipital is visible in the larger, although obliterated in the smaller, an older skull as also indicated by its greater zygomatic and mastoid widths. Its teeth too are a good deal smaller, although not very noticeably worn. The teeth are more worn and still smaller in the oldish ♀ skull from Khatmandu (*Dr. H. A. Oldfield*). There are some further notes on the variations of Nepalese skulls under the heading *S. thibetanus mupinensis*. Judging from Nepalese skins, these skulls belong to *S. th. thibetanus*.

Three oldish skulls from Jaunsar, 8,000-9,000 ft., in Dehra Dun (*B. B. Osmaston*), on the contrary, probably belong to *S. th. laniger*, judging from their altitude. They resemble the 'flatter' type of Assamese skulls as shown by the sketch of the dorsal profile of the ♂ (Text-fig. 7, A, p. 119), which has an unusually strong sagittal crest bifurcating far forwards about the middle of the frontal bones.

Of the skulls assigned to *laniger* from Kashmir the first on the list was shot by Col. C. R. S. Pitman at Dunga Gali in Murree which is politically in the Upper Punjab. It is an old ♂ skull very massively built and broader across the zygomata, and mostly elsewhere, than any other skull of this species I have seen. Its dorsal profile is strongly convex owing to the development of air-cells in the roofing bones. It is even more inflated than the ♂ skull from Vekohomi in the Naga Hills and differs remarkably from the oldish ♂ skull from Jaunsar in Dehra Dun, as shown by the sketches of the two. The second from Kashmir (*St. George Littledale*) is very like it, but not so swollen. It is heavier and everywhere a little broader than the third from Tinjal, Pir Panjal, 7,500 ft. (*C. H. Stockley*), although they are approximately the same age. The ♂ skull from Shalkood (*Mrs. Entwistle*) is not adult but shows the size of the teeth when unworn. The skull from Shamshubi is the skull said to have been taken from the 'red' ♂ variety of this bear shot by Col. C. H. Stockley and discussed above. It is quite old with worn teeth and is decidedly small for a full grown ♂, slightly smaller indeed than ♀ skulls from Dehra and Khatmandu. Of the ♀ skulls I have entered the shortest and the longest. The longer of the two from Malawan, Pir Panjal, 8,000 ft. (*C. H. Stockley*) is adult but not old. The shorter of the two from Aru in the Upper Lidder Valley (Capt. Magrath) is the type of the race. It is quite old, which accounts for its greater zygomatic width, and has the teeth much worn. In addition to the skulls already mentioned, the Museum is indebted to Col. C. H. Stockley for others from Kai-Wan and Mousmoo in Kashmir. I have not been able to find a single character, either cranial or dental, by which skulls from Kashmir can be distinguished collectively from skulls from Assam.

SELENARCTOS THIBETANUS MUPINENSIS, Heude.

Selenarctos mupinensis, Heude, *Mém. Hist. Nat. Chin.* v, pt. 1, p. 2, pl. ii, figs. 1, 2, 9, 1901; Courtois *tom. cit.*, pt. 2, p. 37, 1906; Sowerby, *Journ. Mamm.*, i, p. 219, 1920.

Selenarctos leuconyx, Heude, *Mém. Nat. Chin.*, V, pt. 1, p. 2, figs. 3, 4, 8, 1901; Courtois, *tom. cit.* pt. 2, p. 37, 1906; Sowerby, *Journ. Mamm.* i, p. 225, 1920 (under *Ursus lagomyiarius*, Severtz.).

Ursus troquatus macnelli, Lydekker, *Proc. Zool. Soc.*, 1909, p. 607; Sowerby, *Journ. Mamm.*, i, p. 220, 1920 (*Selenarctos macneilli*).

Ursus clarki, Sowerby, *Journ. Mamm.*, i, p. 226, 1920. (New name for *leuconyx*, Heude.)

Selenarctos thibetanus, G. M. Allen, *Amer. Mus. Novit.*, No. 360, p.l., 1929.

Locality of type of *mupinensis.*—Moupin.

Locality of type of *leuconyx* (*clarki*).—Tai-pei Shan, S. W. Shensi.

Locality of type of *macneilli.*—Ta-chien-lu, W. Szechuen.

Distribution.—Western China: Moupin, Shensi, Szechuen.

The synonymy of this bear needs justification.

The type, a skull, of *S. mupinensis*, came from Moupin, which, according to Sowerby, is part of N.-W. Szechuen and E. Tibet. The name has merely line- and figure-priority over *S. leuconyx*, the type of which, a skull and the paws, was received from the mountains of Pao-chi or the Tai-pei Shan in S.-W. Shensi. The type of *macneilli*, a skull and skin, was from Ta-chien-lu in western Szechuen. The localities are tolerably adjacent in western central China to the north of the Yang-tse-kiang River. It will be seen from the synonymy that Sowerby considered the names symbolical of three species and two genera. From an examination of the alleged typical skull of *leuconyx*, he concluded that it belongs to *Ursus*, not to *Selenarctos* as stated by Heude and Courtois, his reason being the elongation of the muzzle; and since the name *leuconyx* was preoccupied for another bear from the Thian Shan which is certainly an *Ursus*, he proposed *clarki* to replace *leuconyx*, Heude.

But Heude's figure of the skull of *leuconyx* is clearly the skull of a *Selenarctos*, as is shown by the backward setting of the upper cheek teeth and other features. Courtois, indeed, in his revision of Heude's work declared that the alleged cranial and dental differences between *mupinensis*, admittedly a *Selenarctos*, and *leuconyx* 'sont bien fugaces' and that the separation of them depends on the skins. For these reasons I unhesitatingly adopt Heude's and Courtois' opinion that *leuconyx* Heude is a *Selenarctos* and not an *Ursus* as Sowerby claimed.

As for the skin of *leuconyx* all that was known of it was parts of the paws which exhibited partial albinism of the claws and digital hairs, a feature which deceived Heude but was stated by Courtois, of course correctly, to be an aberration.[1]

Lydekker described the type of *macneilli* as an old, presumably male bear in winter coat, differing from Himalayan representatives of the typical race in the greater length and softness of the hair. The skin unfortunately was kept by the collector, Capt. Malcolm MacNeil. The skull, presented to the Museum, is discussed below.

The only skin I have seen is one referred to by Lydekker, a subadult female collected by Berezowski at Loung-ng'an-fou in the mountains of Szechuen. It is dated Oct. 28th, 1893, and has a good coat, although probably not quite fully developed. The general colour is glossy black, with the muzzle deep chocolate brown, a considerable amount of white on the chin and a creamy-white, nearly crescentic breast-mark, narrow in the middle behind, each arm measuring about 8 inches and expanding gradually up to its anterior end. (Text-fig. 6, F.) The hair, mixed with a considerable quantity of underwool, is thick, soft and tolerably long, about 5½ inches on the sides of the neck, 2½ on the back and 3 on the flanks. The flat skin measures only 4½ ft. from the muzzle to the rump.

The coat is a little fuller and softer than in those of the Kashmir race described above as *laniger;* but the difference is not very noticeable and my view that the two bears are racially distinguishable is provisionally based on the assumption that when, if ever, more material of the western Chinese form comes to hand, it will be found that the differences are greater than those shown by the one skin available for examination.

The skull of the type of *macneilli* is not old, as stated by Lydekker. True the teeth are somewhat worn, but most of the cranial sutures, including the basioccipital, are still visible. It had barely attained full length and has none of the marks of age. Lydekker compared it with a skull from the Himalayas. His figure enables me to identify this skull with certainty as one collected by Hodgson in Nepal (Nos. 56, 6, 24, 146), a considerably younger skull than the type of *macneilli* and admittedly differing from it in the particulars mentioned by Lydekker, namely, the narrower zygomata (an age-character), a flatter palate and larger teeth. If Lydekker had compared the Szechuen skull with other Nepalese skulls on the same shelf, and also collected by Hodgson, he would have found some with the palate as hollow and one with the zygomata a little wider and the teeth matching almost to a millimetre in size. The cranial characters of *macneilli* relied on by Lydekker have no value.

The following are the dimensions of the skulls of the types of *mupinensis* and of *leuconyx*, taken from Heude's figures; also of the type of *macneilli* and of the female collected by Berezowski taken from the specimens in the British Museum.

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[1] Under the heading *S. th. thibetanus* I recorded an example from the Garo Hills, Assam, with some white hairs on the digits; and Temminck described a pure albino *Selenarctos* from Nippon, Japan.

Locality and Sex	Skull in English inches						Upper teeth in millim.		Lower teeth in millim.	
	Total length	Cond. bas. length	Zygom. width	Mastoid width	Int. Orb. width	Max. width	Last 3 Teeth	Last Tooth	Last 4 Teeth	Penult. Tooth
Moupin ♂ ?	10·7	10	7·3	5·8	3·2	2·5	60	29×15	67	21×13
S. W. Shensi ♂ ?	10·3	9·6	5·8	4·6	2·7	2·1	55	26×15	63	20×11
Szechuen ♂ ?	10·9	10·5	6·8	5·5	2·7	2·3	54	25×14	55	20×10
,, ♀	9·7	9·3	5·3	4·6	2·2	2·2	57	27×14	58	21×11

The skull from Moupin is the type of *mupinensis*. From its shape and the width of the zygomata, it appears to be adult. The smaller toothed skull from S.-W. Shensi, the type of *leuconyx*, is not only a little shorter but narrower in every detail measured. It may be regarded as subadult. The third on the list, the type of *macneilli*, is slightly longer than the type of *mupinensis*, but is narrower and, as explained above, is a young-adult skull that had not attained full development at all events in width, although it would probably not have surpassed 11 ins. in total length with growth. The teeth, a little worn, are decidedly smaller than in the type of *mupinensis* but very slightly smaller than those of *leuconyx*.[1] These three skulls are unsexed. I infer them to be probably ♂ skulls because of their superiority in size over the known ♀ skull from Szechuen which was sexed by the collector Berezowski. It is subadult and has the unworn teeth about the size of the type of *leuconyx*.

The dimensions of these skulls suggest the possibility of this western Chinese bear being a little smaller than *laniger* from Kashmir; but no definite conclusion can be drawn from the small amount of available material.

SELENARCTOS THIBETANUS USSURICUS, Heude.

Ursus thibetanus, Radde, *Reise im Süd. von Ost. Sibir.*, i, p. 12, 1862.

Selenarctos ussuricus, Heude, *Mém. Hist. Nat. Chin.*, v, pt. 1, p. 2, pl. ii, fig. 10, 1901; Sowerby, *Journ. Mamm.*, i, p. 220, 1920.

Selenarctos thibetanus wulsini, Howell, *Proc. Biol. Soc. Wash.*, 41, p. 115, 1928; *id. Proc. U.S. Nat. Mus.*, 75, p. 21, pls. 6-7, 1929.

Selenarctos thibetanus, G. M. Allen, *Amer. Mus. Novit.*, No. 360, p.1., 1929.

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[1] The collective dimensions of the last three upper and last four lower teeth is a deceptive character sometimes owing to the curvature of the line.

Locality of type of *ussuricus.*—Ussuri (Manchuria).

Locality of type of *wulsini.*—Eastern Tombs, Chihli (N. China).

Distribution.—North China, Manchuria, Amurland, and possibly Kamschatka.

The type of this race is a very young, probably ♀ skull, from Ussuri (Urick) on the Russian boundary of Manchuria. Heude figured the principal cheek-teeth, natural size, and their dimensions, recorded in the table below, are taken from his figures. According to Sowerby Heude had another skull, older but also immature, ticketed Kamschatka.[1]

In Oct. 1914 Sowerby shot an adult pair 20 miles N. of I-mien-po, North Kirin in Manchuria, 700 ft., and gave some useful information about them in his paper quoted above.

The colour of the ♀ was pure black with a well defined white crescentic collar extending to the fore part of the shoulder; chin white. Hair long and soft longer on the sides of the neck and head, giving the appearance of a mane about 8 inches long. Since the bear was killed on Oct. 14, the winter coat must have reached nearly its full development. From the account it was more luxuriant than in the Szechuen bear, *mupinensis*. At all events, the neck hairs are much longer than in Berezowski's Szechuen specimen shot on Oct. 28th.

The only material in the British Museum that I assign to this race is a couple of adult skulls from Amurland presented by Messrs. Rowland Ward. From their size I judge them to be ♂. One is a little longer, everywhere broader and altogether heavier in bone than the other. No doubt it is older. But it also has larger teeth and differs in some instructive structural points. The larger skull has the crown more elevated, nearly $\frac{3}{4}$ of an inch higher than in the other; the post-dental portion of the palate is much narrower, its width at the level of the anterior edge of the mesopterygoid fossa being 1.4 ins. as compared with almost 1.7 ins. in the other; the fore part of the palate in front of the last molar is markedly hollowed instead of flat and the fossa itself is only .7 in. wide in the larger as against 1.1 ins. in the smaller. As regards the teeth, the last upper molar in the larger has its posterior portion normally narrowed with its outer edge slightly concave and oblique, the hinder edge being rounded. In the smaller this end of the tooth is only slightly narrowed, its outer edge being very lightly convex and its hinder edge broad and transversely truncated. (Text-fig. 8, A, B, p. 125.)

In 1928 A. B. Howell gave the subspecific name *wulsini* to some material, including the skin and skull of an adult female, purchased in Pekin and said to have been procured in the mountain forest at the 'Tombs', some 250 miles to the north of that town in Chihli. Mr. Howell evidently had very little material of *Selenarctos* to help him estimate the variability of this bear in the characters he relied upon for distinguishing *wulsini* from *ussuricus*. These were mainly cranial characters; and he pointed out that the skull of *wulsini* is wider across the zygomata, narrower across the interorbital, and has thinner jugals than the female of *ussuricus* shot by Sowerby. But the zygomatic width increases

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[1] Sowerby added 'Corroborative evidence of the existence of this type of bear in Kamschatka is lacking'. Possibly the 'very dark brown or black bears' inhabiting Kamschatka, of which Lönnberg heard rumours, were of this kind. (*Proc. Zool. Soc.*, 1923, p. 93, footnote.)

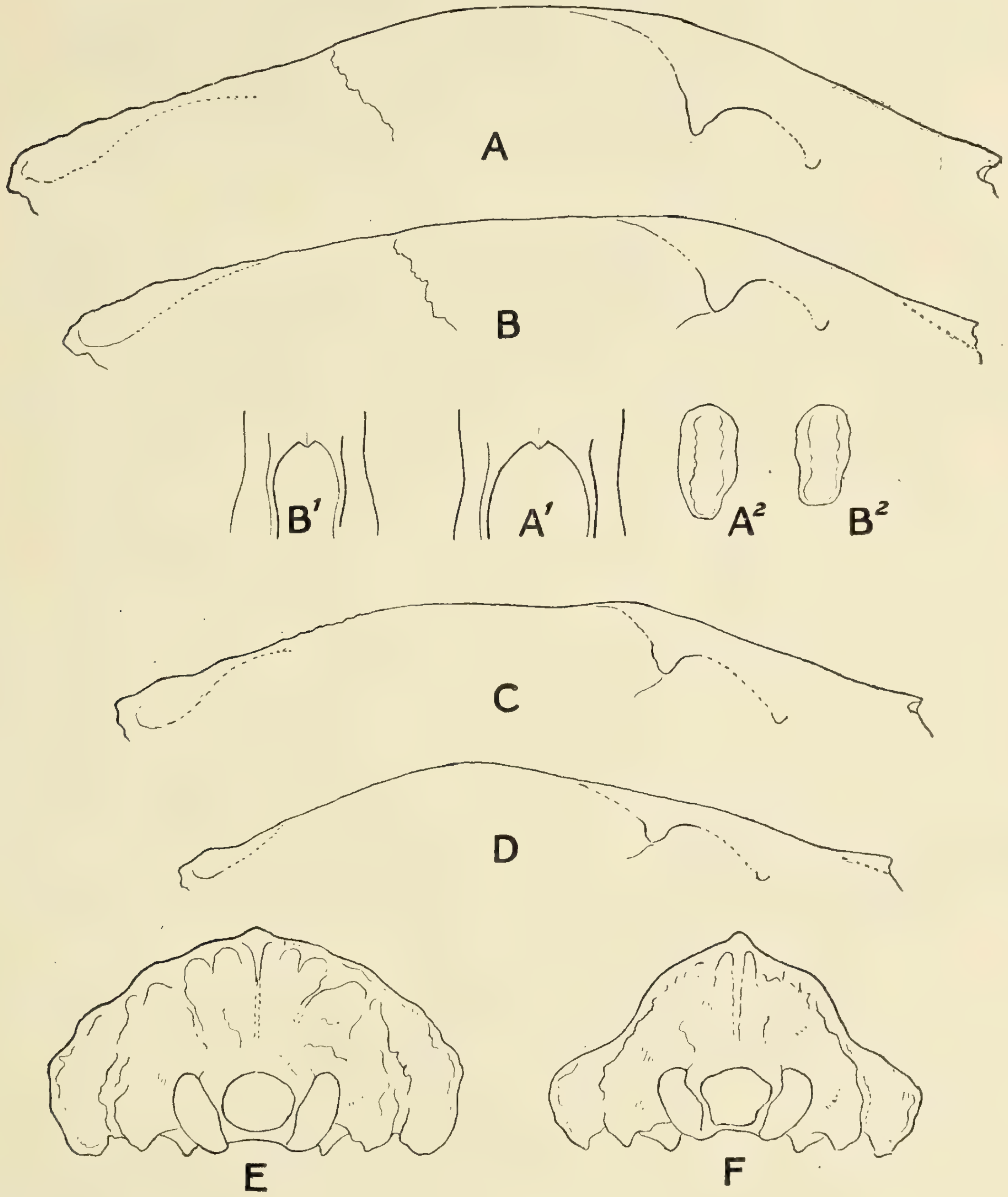

Fig. 8.

A. Upper profile of skull of larger example of *S. thibetanus ussuricus* from Amurland.
A^1. Mesopterygoid fossa of the same.
A^2. Last upper molar of left side of the same.
B. Upper profile of skull of smaller example of *S. thibetanus ussuricus* from Amurland.
B^1. Mesopterygoid fossa of the same.
B^2. Last upper molar of left side of the same.
C. Upper profile of skull of adult male of *S. thibetanus formosanus* from Formosa.
D. The same of adult female.
E. Back of skull of adult male of *S. thibetanus formosanus* from Formosa.
F. The same of adult female of *S. thibetanus japonicus* from Yamato, Japan.

with the age and the skull of *wulsini*, with its fused facial sutures, is obviously older than the skull of Sowerby's example in which these sutures are still open. I have given the recorded dimensions of the skull of the type of *wulsini* in the table published below; but I cannot on the available evidence regard *wulsini* as distinct from *ussuricus*.

The following table gives the cranial and dental measurements of the skulls known to me which I assign to this northern race.

	Skull in English inches						Upper Teeth in millim.		Lower Teeth in millim.	
Locality and Sex	Total length	Cond. Bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 Teeth	Last Tooth	Last 4 Teeth	Penult. Tooth
Amurland ♂	12·5	11·7	7·6	6·3	3·3	2·7	64	31×16	71	21×14
,, ♂ ?	12·0	11·1	6·8	5·8	3·0	2·5	60	29×14	67	21×11
Ussuri ♀ ?	...	...	...	...	...	...	53	25×15	63	19×12½
Kirin ♀	11·8	...	7·2+	...	2·9	2·6+	...	27×15	...	...
Chihli ♀	11·8	...	7·8	...	2·6	...	...	30× ?	...	...

The first two on the list are the two presented by Messrs. Rowland Ward. They are just adult, but by no means old, skulls and would probably have altered considerably in width and other respects with increasing age. The principal differences between them, described above, are illustrated in the adjoining text-figures (Text-fig. 8, p. 125). The smaller of the two may be a ♀. If so the bear was a very large individual of the sex. Only the tooth measurements of the example from Ussuri, the type of the race, are available. They are taken from Heude's figure and, even allowing for inaccuracies, are obviously much smaller than those of the Amurland skulls. The dimensions of the two ♀ skulls from Kirin and Chihli are taken from the data supplied respectively by Sowerby and Howell, the Chihli skull being the type of *wulsini*. It will be noticed that the last upper molar of the Kirin example is not much bigger than in the type from Ussuri. It is bigger in the Chihli ♀; but according to G. M. Allen this tooth varies from 28 to 32 mm. in length in skulls from Chihli. In Sowerby's ♂ from Kirin it was 30 mm. In the alleged Kamschatka specimen referred to by Sowerby it was 31 mm., exactly the same as in the larger Amurland skull.

When this table is compared with that of the western Chinese bears, referred to *mupinensis*, it suggests that the northern race is a larger form, with, on the average, slightly larger upper teeth. This provisional inference, coupled with the apparent difference in thickness and length of the coat, has induced me to keep the bears from the two areas under separate headings. If ultimately found to be inseparable the name *mupinensis* has line priority.

A peculiarity of *S. ussuricus* is the comparatively small difference in the skulls of the ♂ and ♀. The two adult ♀ skulls are a good deal larger than any of the adult ♀ skulls from India that I have measured. The larger of the two skulls from Amurland, certainly ♂, is a little longer, especially in condyol-basal length, than any of the ♂ Indian skulls; but the larger of the two ♂ skulls from Nepal would have come very near it, I suspect, if fully developed. Clearly measurements of more Chinese skulls are required to establish or refute the conclusions suggested.

My views about these Chinese bears, *mupinensis* and *ussuricus*, were written before I saw G. M. Allen's opinions on them published in 1929. Since our verdict regarding the status of *wulsini* is identical, I have left my paragraph exactly as it was written on account of the value of the same conclusions being independently reached from the examination of different material.

Allen, however, considers that, apart from *melli*, the Chinese representatives of *Selenarctos* must be assigned, on the available evidence, to the same race; and for this he adopts the name *thibetanus*, thus identifying the Chinese with the Indian bears of which he had very little material. He was the first to point out the unreliability of the shape of the skull and the size of the teeth upon which previous authors, Lydekker, Sowerby and Howell, had based the subspecies they discussed. His remarks upon the individual variability of these characters are confirmed in every detail by the skulls I have examined.

SELENARCTOS THIBETANUS JAPONICUS, Schl.

Ursus thibetanus.—Temminck, *Fauna Japonica*, p. 29, 1844.

Ursus japonicus.—Schlegel, *Handl. Dierkunde*, 1, p. 42, 1857; Sclater, *Proc. Zool. Soc.* 1862, pp. 187 and 261, pl. 32; Günther, *Proc. Zool. Soc.* 1880, p. 442, fig.

Selenarctos japonicus, Heude, *Mém. Hist. Nat. Chin.* V, p. 2, pl. ii, figs. 5-7, 1901; Sowerby, *Journ. Mamm.*, I, p. 222, 1920.

Ursus rexi. Matschie, *SB. Ges. Nat. Fr. Berlin*, 1897, p. 72.

Locality of type.—unrecorded.

Distribution.—Mountainous parts of the Japanese Archipelago (Temminck).

Notes on the synonymy.—Temminck identified this bear as *Ursus thibetanus* because he could not distinguish it from the Assamese bear described by Cuvier under that name; and since Cuvier described the white chin and breast-mark in the type from Sylhet, it seems that Temminck knew Japanese skins with those features. Schlegel seems to have guessed that it might be distinct when he proposed *japonicus* for it. Five years later Sclater came independently to the same conclusion as Schlegel and by chance chose the same name. From an examination of living specimens he described the 'species' as hardly two-thirds the size of the Indian black bear, with an evanescent gular band, a much blacker muzzle and no prominent bushy cheeks. Matschie gave the name *rexi* to a specimen from Japan because it differed from those described by Sclater in having a white chin and a distinct white gular band. Since, however, the skins of typical *S. thibetanus thibetanus*, described above from Assam, show that the colour of the muzzle and chin and the size and colour of the gular band are exceedingly variable individually, I cannot on the evidence of one skin attach any importance to the features on which *rexi* was named. There is also the above stated inference regarding Temminck's observations to be considered in this connection.

My acquaintance with Japanese bears living in the Zoological Gardens bears out Sclater's remarks regarding their small size as compared with Indian specimens. There are two skins in the British Museum:—

1. A mounted specimen (*Zool. Soc.*), apparently adult, measures 4 ft. from snout to rump. The colour is glossy black, with the muzzle dark brown, darker than in some but not all Assamese[1] examples, and the chin is the same tint as the snout, thus differing from many but not all Assamese examples. There is, however, no breast-mark. The coat is full, soft and longish, with abundant brown underwool. On the back the hair is about 2¾ ins. long, on the nape 3 ins. and on the sides of the neck close upon 4 ins.

2. A flat skin (*Zool. Soc.*) closely resembles the last but has a small white transverse breast patch measuring ½ × 1¼ ins. and the coat a little shorter, 2½ ins. long on the back, about 3½ on the sides of the neck where it is wavy and curly. On the paws the hair is remarkably long, about 2¼ ins. bordering the plantar pads and over 1½ ins. between the digital pads which it largely overlaps and conceals. This is perhaps a 'captivity character'.

Very little is known about the skull. There are only two in the British Museum. One is fully adult and no doubt ♀; the other is quite young. Both came from Yamato (H. Pryer). The older skull was described by Günther in 1880; and on the evidence of it he followed Sclater in giving full specific status to *japonicus*, relying on the absence of the inner lobe of the upper carnassial (the antepenultimate) tooth, this lobe being present in the Himalayan black bear. But quite evidently its absence in the Japanese skull is due to attrition. The position of the lobe is marked by a scar of brown dentine with an edging of enamel. The lobe, moreover, is present and cusped, although decidedly small, in the young skull with unworn teeth. This young skull shows no points calling for further comment; but the adult skull is normal in shape and 'low-browed' and is decidedly small considering its age, the complete obliteration of the sutures, except the facial, suggesting cessation of growth, at all events in length.

Heude published figures of the skull, ⅓ nat. size, and of the principal cheek-teeth, nat. size, of a specimen from Nippon. The dorsal contour of the skull closely resembles that of the adult ♀ from Yamato. I suspect it is the skull of a ♂, because it is larger than the full sized Yamato ♀ but is obviously immature as attested by the open cranial sutures, even the interparietal being unclosed. Commenting on this skull Sowerby remarked that it 'undoubtedly represents the Japanese black bear at once distinguishable from the mainland forms of *Selenarctos* by the extreme narrowness . . . of the skull'. Considering the obvious immaturity of the skull, its narrowness has no systematic value.

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[1] It may be recalled that Duvaucel described the muzzle of the type of *thibetanus* as black.

The measurements of these three skulls are given in the subjoined table, those of the specimen from Nippon being taken from Heude's figures. The size of the skull of *japonicus* confirms the conclusion derived from the observations on living animals, on the mounted skin in the British Museum, measuring 4 ft., and on a specimen over 18 years old recorded by Temminck also as 4 ft., that the Japanese race is smaller than the Chinese and Indian races described above. It appears indeed to be the smallest of the subspecies of *Selenarctos*. The teeth, which are remarkably coincident in size in the three specimens, are also small.

Skull measurements of the Japanese and Formosan Black Bears.

	Skull in English inches						Upper Teeth in millim.		Lower Teeth in millim.	
Locality and Sex	Total length	Cond. Bas. length	Zygom. width	Mastoid width	Int. orb. width	Max. width	Last 3 Teeth	Last Tooth	Last 4 Teeth	Penult. Tooth
japonicus.										
Nippon ? ♂	9·4	8·9	5·8	...	2·3	1·9	48	24×14	57	19×11
Yamato. ♀	9+	8·6	5·7	4·3	2+	1·9	50	24×13	57	19×11
,, (young)	7	6·8	4	3	1·6	...	50	24×13	...	...
formosanus										
Formosa ♂	10·4	...	7·1	5·4	2·4	2·3	53	25×14	60	19×11
,, ♂	10·3	9·8	6·8	5·2	2·4	2·4	58	28×15	65	20×12
,, ♀	9·4	...	6·1	4·9	2·3	2·1	51	25×14	58	18×10
,, ♀	9·3	8·7	6	4·7	2·2	2	52	25×14	57	18×11

SELENARCTOS THIBETANUS FORMOSANUS, Swinh.

Ursus formosanus, Swinhoe, *Proc. Zool. Soc.* 1864, p. 380.

Ursus torquatus formosanus, Lydekker, *Proc. Zool. Soc.* 1909, pp. 607-610, text-fig. (skull).

Selenarctos formosanus, Sowerby, *Journ. Mamm.*, 1, p. 223, 1920.

Selenarctos melli, Matschie, *Arch. Naturg.*, 88, pt. 10, p. 34, 1922; G. M. Allen, *Amer. Mus. Novit.*, No. 360, p. 3, 1929 (as subspecies of *S. thibetanus*).

Locality of type of formosanus.—Formosa.
Locality of type of melli.—Kwangtung, S. China.
Distribution.—Formosa and possibly S. China.

This bear was described by Swinhoe, approximately rightly, as intermediate in size between the bears of Japan and Tibet. He recorded the length as 4½ ft. from snout to tail-root. The coat is short and rigid, the colour black with a crescent-shaped patch on the chest white in the adult but apparently brown in the young. He did not examine a complete skin and the only skin he sent to the British Museum is very imperfect, being without the head and paws. This may be regarded as the type (No. 62, 12, 24, 26). The coat is somewhat scanty, coarse and short, the hairs only about 1½ inches in length. There is no crest on the neck, the hairs here being quite short, looking as if they had been singed. The chest patch is V-shaped, creamy buff in tint and about 4.8 inches along each arm.

Swinhoe procured, however, a good series of skulls, six in all, comprising two apparently adult males and females, which I have sexed by their size. Their dimensions are entered in the table given above. All are 'low-browed'. Of the first two, identified as ♂, the second was figured by Lydekker as the type. That claim, however, cannot be substantiated, since Swinhoe described the bear from a skin and there is no evidence that any one of the skulls he sent to the Museum 6 years later belonged to that skin. Although barely full sized, as indicated by the unfused upper sutures, this skull is a little longer and less inflated on the brow than the first which is comparatively old, with the teeth smaller and worn. The two ♀ skulls are about the same age as the older ♂ skull. They are flatter on the forehead and have widely lyrate temporal ridges as in the skull of *japonicus* from Yamato which is just about the same age. From the comparatively small amount of variation exhibited by these Formosan skulls I suspect they are 'inbred' stock from the district where Swinhoe was stationed. (Text-fig. 8, C, D, p. 125.)

From the scanty material available *formosanus* may be distinguished from *japonicus* by its slightly larger size and shorter, thinner coat. In this respect it resembles typical *thibetanus* represented by the Assamese skins; but the skull shows it to be a smaller bear. There is, however, one noticeable difference in the skulls. In the Japanese skull the occipital crest is much smaller and when seen from behind exhibits a deep, wide concavity above the mastoid processes. This is at most faintly indicated in one or two of the Formosan skulls in which the contour of the occipital crest is sinuously convex from the summit to the mastoids. I have figured this difference on the chance of further material proving it constant in these races. But at present no systematic importance can be attached to it, because the series of typical *S. thibetanus* skulls from the Naga Hills shows equally great individual variation. (Text-fig. 8, E, F, p. 125.)

I suggested above that the Southern Chinese bear, described by Matschie as *S. melli*, might be the same as the typical Assamese race of *S. thibetanus* which, on the evidence of a skin, I have traced as far eastwards as Annam. But it is equally, perhaps more, likely to be assignable to *formosanus*. Matschie's description is, of course, valueless; but G. M. Allen identified the skin and skull of an old ♂ from Fokien as *S. th. melli*. This ♂ skull, he says, is about the same size as an adult ♀ skull from Shensi, and 'obviously' smaller than large skulls of *thibetanus* assumed to be ♂. Moreover, the skin, taken in April, in full winter coat is 'much shorter haired' than the winter skins from Chihli. His remarks about the size of the skull apply to the ♂ skulls of *formosanus*, and the comparative shortness of the winter coat is in keeping with the extreme shortness of the presumably summer coat of the typical skin of *formosanus*.

GENUS: HELARCTOS.

Helarctos, Horsfield, *Journ. Zool.*, ii, pp. 221 and 233, 1826; Pocock, *Ann. Mag. Nat. Hist* (9), i, p. 383, 1918.

The principal resemblances and differences between this bear and *Selenarctos*, tabulated in the first part of this paper, need not be repeated in detail. The chief external differences lie in

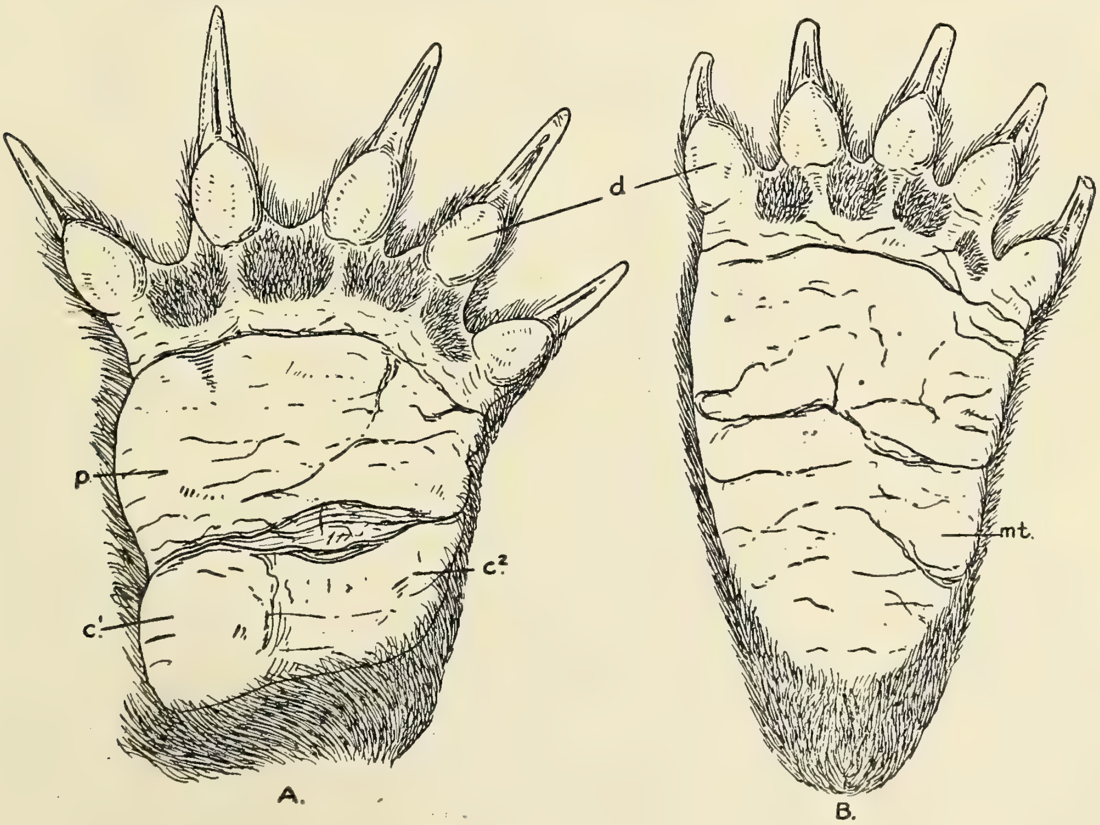

FIG. 9.

A. Lower side of right fore paw of *Helarctos malayanus*.
B. The same of right hind paw. Lettering as in Fig. 1.

the generally shorter and broader head of *Helarctos*, with its small, rounded, broad-based, defectively cartilaginous ear, its modified rhinarium and more protrusible lips and tongue. The feet are similar, but the fore limbs are more bowed, with the paws turned inwards in adaptation to a more arboreal habitat. The coat is shorter, sleeker, never so shaggy, with some differences in the hair-slope on the neck, pointed out below.

In the skull the chief differences lie in the abbreviation of the jaws, the relatively large canine and incisor teeth, expanding the muzzle in front and shortening the series of cheek teeth to the extent sometimes of practically crowding out the small anterior premolars and bringing the canines almost in contact with the first larger premolar above and below. This is accompanied by an extraordinary development of the bony areas of the cranium to which the neck and jaw muscles are attached, the exceptionally wide zygomata and mastoids and the high sagittal crest, the back of the skull being less depressed than in *Selenarctos;* but the brow may be inflated or flat and the top of the muzzle steeply or gently sloped as in that genus.

Helarctos malayanus, Raffles.

Ursus malayanus, Raffles, *Tr. Linn. Soc. Zool.*, xiii, p. 254, 1822; *id. Zool. Res. Java.* 1824; G. Cuvier, *Ossemens Foss.*, iv, p. 324, 1823; F. Cuvier, *Hist. Nat. Mamm.*, ii, No. 214, p. 1, 1824, and *Tabl. Gén. et Méthod.*, p. 3 (*malaianus*); Blanford, *Mamm. Brit. India*, p. 199, 1888, and of many subsequent authors including Lydekker.

Helarctos malayanus, Horsf., *Zool. Journ.*, ii, p. 234, 1826; Cantor, *Journ. As. Soc. Beng.*, xv, p. 191, 1846; and of some recent authors.

Helarctos euryspilus, Horsf., *Zool. Journ.*, ii, p. 221, pl. vii, 1926.

Helarctos annamiticus, Heude, *Mém. Hist. Nat. Chin.*, v, pt. 1, p. 1, pl. i, figs. 1-2, 1901.

Ursus malayanus wardi, Lydekker, *Proc. Zool. Soc.*, 1906, p. 997, text-fig. 142 (skull).

Locality of type of *malayanus.*—Sumatra.
Locality of type of *euryspilus.*—Borneo.
Locality of type of *annamiticus.*—Annam.
Locality of type of *wardi.*—alleged to be Tibet.

Distribution.—Assam, Burma, Indo-China, thence southwards through the Malay Peninsula to Sumatra, Java and Borneo.

Notes on the synonymy.—Horsfield separated the Bornean specimen he named *euryspilus* from typical *malayanus* because its breast-patch was orange-coloured and shield-shaped, not white and crescentic, and because its toes were tipped with grey hairs. Since examples from north and south Borneo which I have seen do not exhibit these features, I regard them merely as individual aberrations. The name *annamiticus* was given by Heude to three skulls from Annam, which he declared differed from the skull of the Sumatran *malayanus* in the steeper slope of the muzzle and in some differences in the cheek-teeth. To illustrate the steepness of the slope of the muzzle he figured a very old skull, no doubt ♂, without any cheek-teeth. But the slope of the muzzle in this bear is partly a sexual, partly a senile character and individually variable; and the alleged differences in the teeth are no doubt also individual. At all events since the unworn cheek-teeth of skulls from Annam and Cochin China that I have seen differ in no respects from those of skulls from Sumatra and elsewhere, I regard the Annam and Sumatran bears as inseparable.

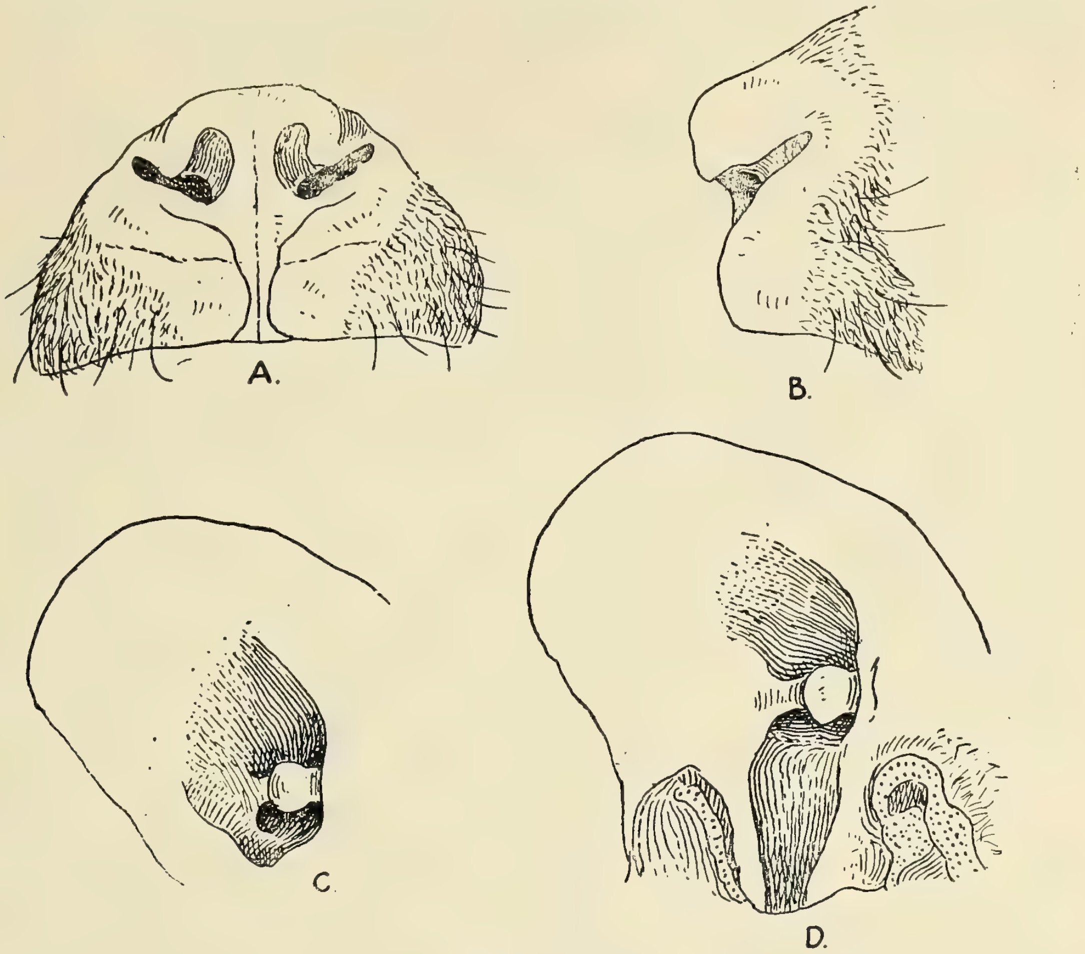

Fig. 10.

A. Rhinarium of *Helarctos malayanus* from the front.
B. The same from the side.
C. Ear of the same entire.
D. The same cut open to show absence of vertical cartilaginous ridges. (For comparison with ear of *Ursus* figured in Part I of this paper.)

The story of *wardi*, fully told by its author, may be briefly restated. The name was given by Lydekker to a skull of *Helarctos* reported to have come from Tibet, but admittedly indistinguishable from the skull of typical *malayanus*. The pretext for naming it was a similar skull previously reported to have come from Tibet with its skin which carried a thick coat quite different from that of more southern examples of *Helarctos*. This skin, with its skull, was mounted and sent to Bergen; but the photograph Lydekker procured of it was clearly a *Selenarctos* with its thick coat and large ears. He thought, however, that it might be a *Helarctos*. I have no doubt whatever that the skin was the skin of a *Sele-*

narctos which may have come from Tibet. But since the skull certainly did not belong to it, the evidence that the skull was from Tibet is quite inconclusive. The evidence that the second skull was from Tibet also, in my opinion, amounts to very little.[1] At all events since I cannot distinguish this skull from Burmese and Malayan skulls of *Helarctos*, I have added *wardi* to the synonymy of *malayanus*.

Description.—The coat, when perfect, is comparatively short and sleek, although thickish and provided with underwool; but it becomes thin and harsh as the moult approaches. It further differs from that of other bears in the presence of two whorls on the shoulders whence the hair radiates in all directions, running forwards along the nape and to a varying distance over the crown. On the sides of the neck there is, as in *Selenarctos*, a crest formed by the meeting of the downward stream from the nape and the upward stream from the throat. There is also in the centre of the breast-patch a parting whence the hairs radiate. This is not present in *Selenarctos*.

The colour is typically jet black, but the dead coat may be tinged with brown, or faintly speckled with buff. The paws are often brownish marginally. The muzzle is always greyish tan, or mealy, above and below, and this tint blends round the eyes with

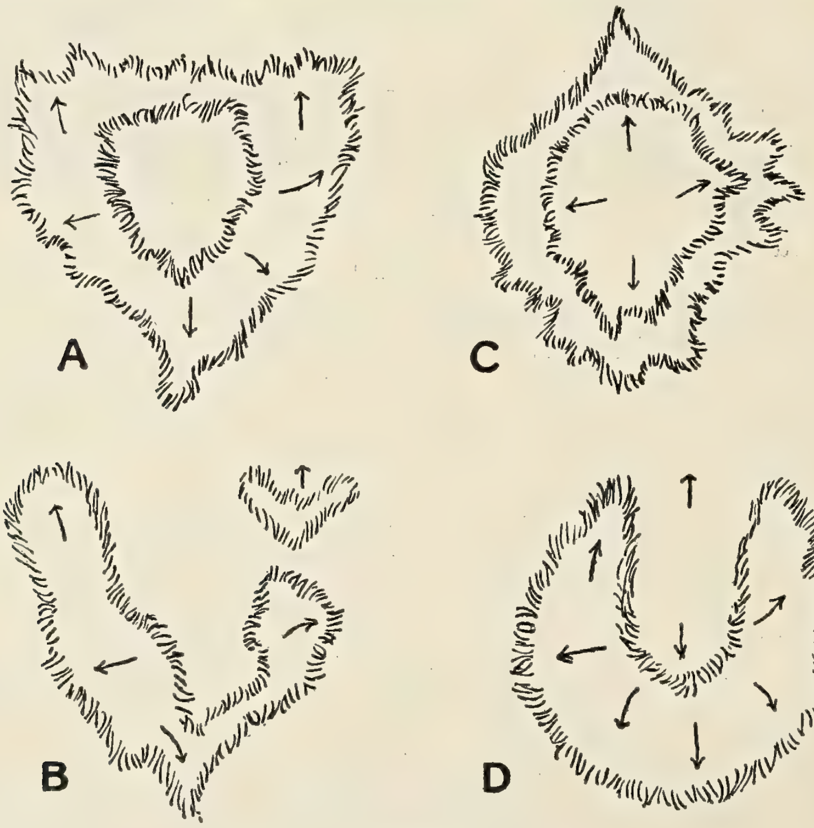

FIG. 11.

Breast patch or collar of Malayan Bears (*Helarctos malayanus*). A & B. examples from the Malay Peninsula; C. from Sumatra; D. from Cochin-China. The arrows indicate the direction of the hair-growth.

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[1] Since *H. malayanus* has been reported from Assam—Blanford records it from the Garo Hills—it may possibly have a more northern distribution and cross the border between British territory and Tibet. But it is significant that the collectors for the Mammal Survey of British India secured no examples of it either in Assam or Upper Burma.

the brown hairs of the head. The breast-patch is usually buff, cream or dirty white, more rarely ochreous. In shape it is typically more or less crescentic, but one arm may be much bigger than the other; not uncommonly the arms coalesce in front, enclosing a black area, the pale hairs may even invade the central area making the patch shield-shaped. The claws are black. The adult ♂ measures about 4 ft. from the snout to the root of the tail and the adult ♀ about 3½ ft. According to Cantor the young has the coat speckled.

I have seen numbers of living examples of this bear from various localities. They were all alike; and since the skins in the British Museum from widely separated districts, nearly covering the known range of the species, supply no evidence of subspecific differentiation, it is needless to describe them in detail. There are, however, no skins from Assam, the nearest locality to that country whence a skin has come to hand being 20 miles N. of Pegu where in the Zamagi Reserve Mr. J. M. D. Mackenzie secured for the Mammal Survey an adult ♀, with the head and body measuring 3 ft. 5 ins. and the ear 2 ins. Its breast-patch is crescentic.

A young specimen from Cochin China (*Boucard*) and another, also young, from Hué in Annam (*Delacour and Lowe*) geographically represent *annamiticus* Heude. There is nothing distinctive about them; and except that the Annam specimen, collected in February, has a shorter and scantier coat, the two are indistinguishable.

Of two mounted specimens, ticketed Malay Peninsula, one measures 4 ft., the other 3½ ft. long. In the former the breast-patch is nearly circular, in the latter it is asymmetrical, the right branch being thick and longish, the left quite short and narrow. Both are normally coloured and in good coat. But a young female from Wellesley Province, in the Peninsula, is in poor coat, with the moult apparently imminent; there is some brownish hair on the back and a pale cast is given to the general dark hue of the upper side by a speckling of buff at the tips of the hairs. The breast-patch is simply crescentic. These three specimens from the same country are interesting from the evidence supplied of individual variation of the breast-patch and of colour-change, no doubt seasonal, in the coat.

Two from Sumatra geographically represent typical *malayanus*. A young female from Sungei Kumbang is in good coat and has the breast-patch irregularly quadrate, the two branches joining in front. The other, ticketed merely Sumatra, has the coat short and coarse and the breast-patch crescentic.

Two young specimens from Borneo geographically represent *eruyspilus*, Horsfield, but do not exhibit the characters upon which that alleged species was based. Both are black with the breast-patch crescentic and cream coloured.

The following table gives the dimensions of the skulls of six adult examples in the British Museum. In addition to these there are immature skulls from Hué, male, and Quantri, female, in

Annam, Cochin China; Wellesley Province, Malay Peninsula, female; Sungei Kumbang, Sumatra; Saribas, Sarawak, male, and Martopoera, Borneo. With regard to these it need only be said that the last upper and the penultimate lower tooth are about the size of those of the two Bornean specimens entered in the table, and, although unworn, are a little smaller than those of the first five examples. An exception to this is afforded by the penultimate lower tooth of the example from Sumatra which is 1 mm. larger each way than the same tooth, which is worn, in the female from S.-W. Siam. The smallest last upper-tooth, measuring 18×12 mm., is found in the female from Wellesley Province.

	Skull in English inches						Upper Teeth in millim.		Lower Teeth in millim.	
Locality and Sex	Total length	Cond. Bas. length	Zygom width	Mastoid width	Int. orb. width	Max. width	Last 3 Teeth	Last Tooth	Last 4 Teeth	Penult. Tooth
Tonghoo, Burma. ♂	10·9	...	8·5	6·9	2·8	3·2	47	22×14	61	17×11
Bukit Besar, Mal. Pen. ♂	10·6	9·7	8·7	6·5	2·7	3·1	45	21×13	58	...
(Lidth de Jeude), ? Java ♂	10·2	9·4	8·5	6·7	2·7	2·8	49	22½×14	60	17×11
(Tibet, *wardi*). ♂	10·0	9·4	8·1	6·7	2·9	2·9	49	21×14	56	17×11
Sai Yoke, S.W. Siam, old, ♀	9·3	8·9	7·6	6·1	2·6	2·8	50	22×13	55	16×11
Brit. N. Borneo ad. ? ♀	9·3	8·6	7·3	5·9	2·3	2·7	49	21×14	...	...
Sarawak ad. ♀	8·1	7·5	6·2	4·9	2·0	2·1	45	19×13	51	16×10
Sungei Kumbang, Sumatra	...	...	...	...	...	...	46	20×14	55	16×11
Quantri, Annam, ♀	...	...	...	...	...	...	45	20×14	53	16×11

The two young skulls, at the end of the table, from Sumatra and Annam may be regarded as topotypes of *malayanus* and *annamiticus* respectively. I have given the measurements of the teeth to show their equality in size. Heude claimed that in his Annam skulls the teeth were much larger than in a Sumatran skull. No doubt they were.

The skull from Tonghoo (*E. W. Oates*), the longest in the Museum collection,[1] although unsexed, is unquestionably that of an old male. There is no trace of a suture, even on the face. It has a high, convex dorsal profile with the brow considerably inflated and the face abruptly sloped down to the nasals which are in a slightly higher plain. The sagittal crest is unusually well developed. About the same age and very nearly as long but slightly wider across the zygomata is the skull marked male, from Bukit Besar in the Malay Peninsula (*Robinson and Annandale*). But the forehead is not so inflated and the nasals are produced and depressed distally giving a very different aspect to the facial profile. A little smaller than the last, but also no doubt identifiable as a male, is a skull labelled 'Lidth de Jeude' which probably came from the Dutch East Indies and more likely than not from Java like the series of Tigers' skulls, similarly labelled, which I referred to in this *Journal* in 1929. The facial profile in this skull is even straighter than in the Bukit Besar skull, the nasals being practically invisible from the lateral aspect. The type-skull of *wardi* is a trifle smaller, but not so old. Its frontal profile is very much as in the Bukit Besar skull, but becomes

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[1] In Ward's *Records*, 1928, p. 503, there is an entry of a skull, also unquestionably of a male, from Java which is a little longer, but not so wide, its measurements being 11⅛ inches by 8⅛. The rest of the skulls there entered appear to be female, being between 8 and 9 inches long.

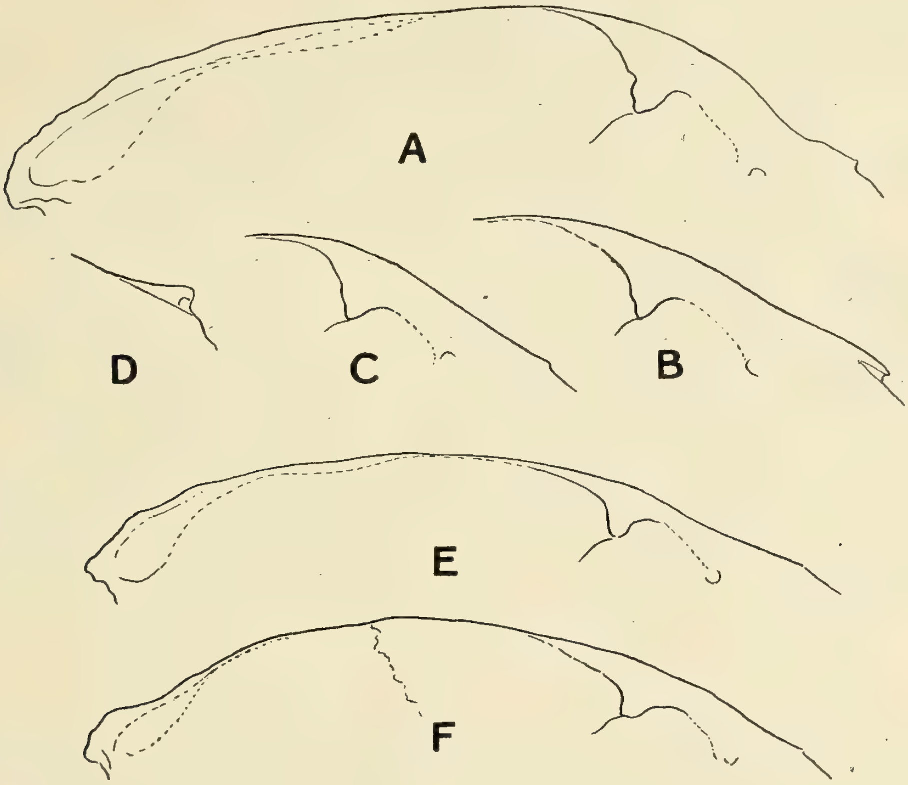

Fig. 12.

A. Upper profile of skull of old male *Helarctos malayanus* from Toungoo, Burma.
B. Frontal profile of skull of old male of the same from Bukit Bezar, Malay Peninsula.
C. The same of a specimen probably from Java.
D. Nasal profile of the type of *H. malayanus wardi*.
E. Upper profile of adult female from Sai Yoke, S.W. Siam.
F. The same of a specimen, supposed to be a female, from British North Borneo.

slightly concave at the base of the nasals which are nearly horizontal, giving a 'snub-nosed' appearance to the face.[1]

The only adult skull I have seen, which was identified by the collector as a female, is the one from Sai Yoke in South-West Siam (*K. G. Gairdner*). It is an old skull without trace of sutures, older even than the male from Tonghoo judging by the more worn teeth. It is decidedly smaller than the skulls described above as males and noticeably less swollen in the frontal region and has the facial profile less steeply sloped.

From British North Borneo and Sarawak respectively there are two adult skulls, both unsexed. The larger of the two closely resembles, in its dimensions and shape, the skull from S.-W. Siam, except that the dorsal profile is a little higher and more convex. It is also narrower in every respect, no doubt because it is younger. I find it difficult to believe that this skull, about as old as the type of *wardi* but much smaller in every way, is other than a female skull. But the one from Sarawak (*Wallace*) is also adult but is much smaller. Hence it is possible that these two skulls are male and female, representing a small Bornean race (*euryspilus*) in which the male is only equal to the female of *malayanus* in size. But the skulls of bears are so variable in size and other particulars, and the material available is so inadequate that, in my opinion, the evidence for the existence of more than one kind of *Helarctos malayanus* is at present negligible.

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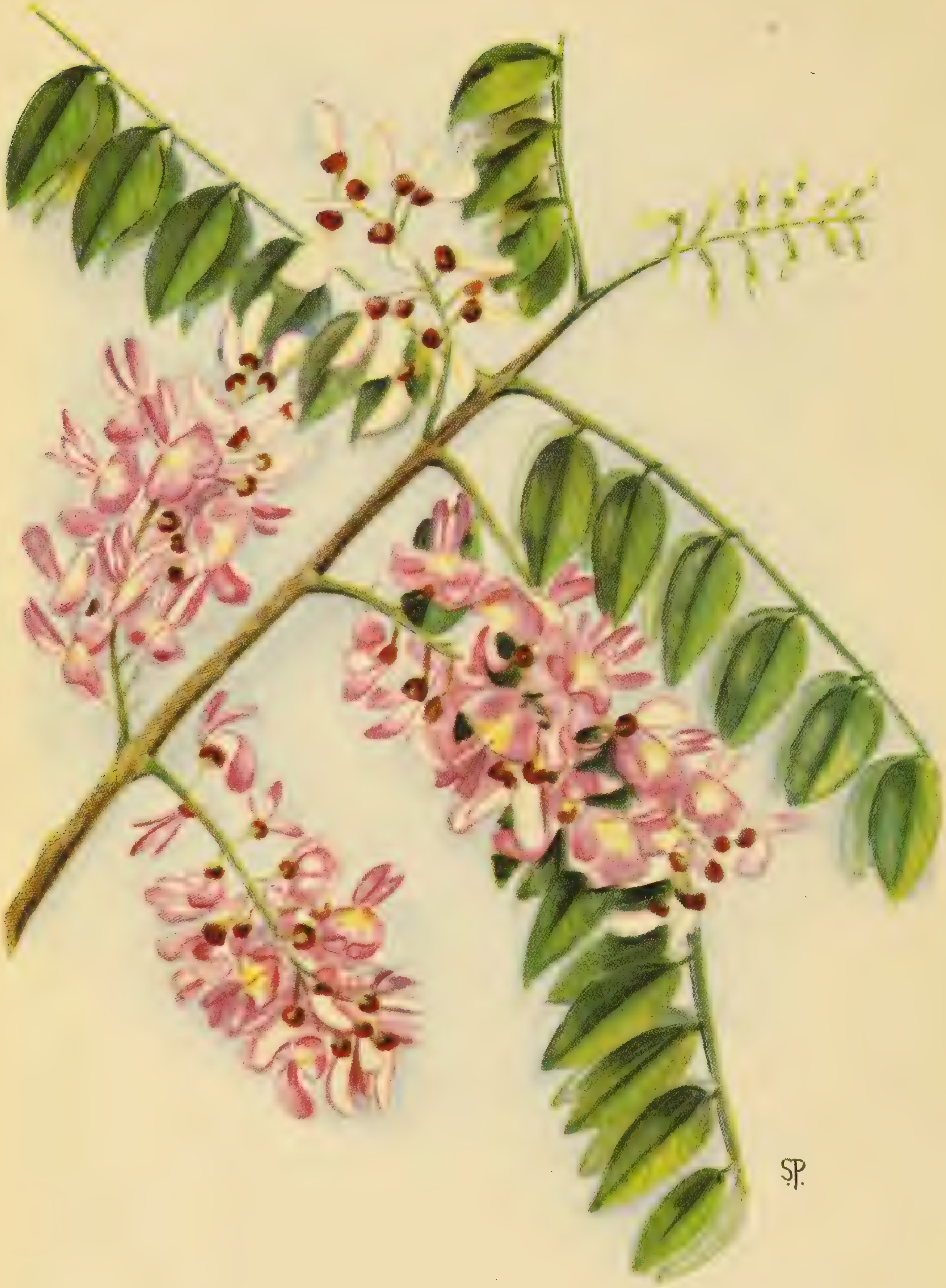
[1] The variation in the shape of the facial profile in the male skulls above recorded convinced me that this feature has not the value assigned to it by Heude when he gave a new name to skulls from Annam.



John Bale Sons & Danielsson L^td London.

THE SPOTTED GLIRICIDIA.
Gliricidia maculata, H.B & K.
(about ½ nat. size).

SOME BEAUTIFUL INDIAN TREES

By E. Blatter, s.j., ph.d., f.l.s., and W. S. Millard, f.z.s.

Part X.

(With one coloured plate, one black & white plate and 2 diagrams).
(Continued from page 825 of Vol. XXXV)

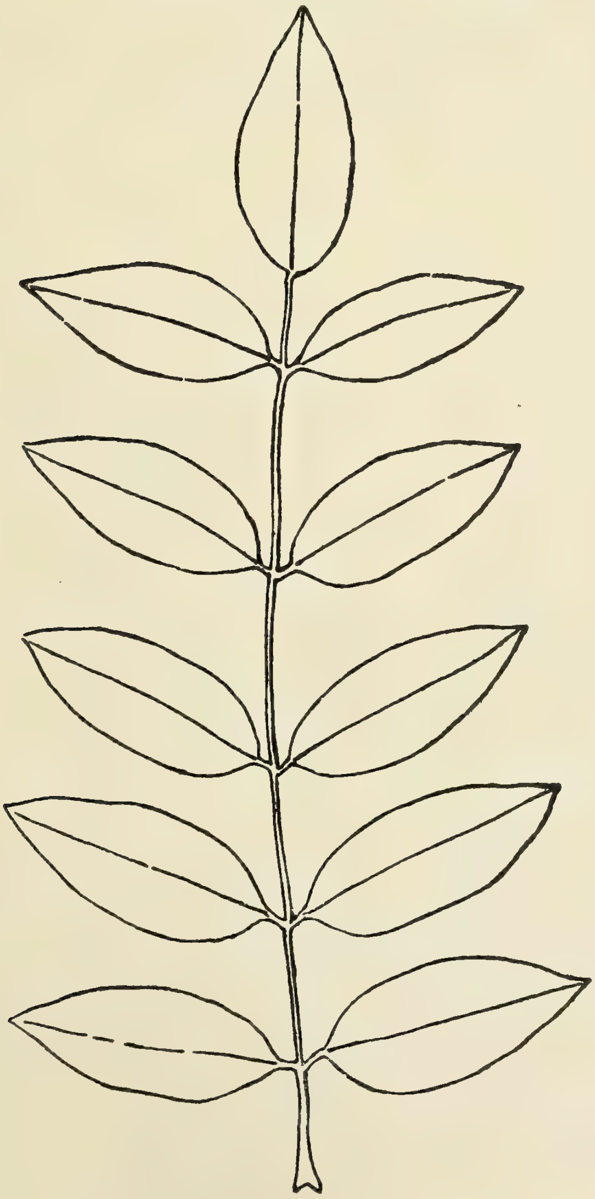
The Spotted Gliricidia.

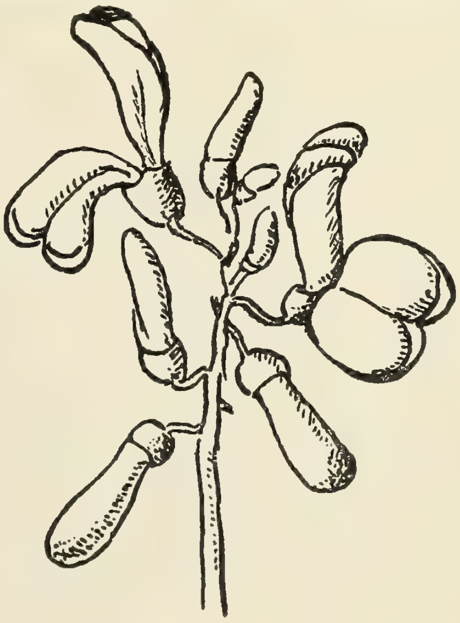
Popular Names: Madre or Madre de Cacao of South America.

Gliricidia maculata, H.B.K. Nov. Gen. & Sp. vi, 393 (*Papilionaceae*).

The generic name means 'rat-destroying' in reference to the seeds which are believed to be effctive as rat poison—*maculata* meaning spotted—describes a character of the under-surface of the leaves.

Description.—A small elegant and quick growing tree with arching branches and feathery foliage somewhat reminiscent of the Cassias. The leaf is described as odd pinate, the leaf stalk bearing 8 pairs of pinnae or leaflets and with an odd terminal leaflet. The leaflets are oblong in shape, blunt at the apex, covered with a mat of fine hairs above and dull green below, the black spotting on the under-surface of the leaves gives the tree its specific name. The tree sheds almost all its leaves during the cold weather when it flowers.





It is strikingly beautiful in bloom when its branches for the greater part of their length are covered with masses of pinkish purple or pale pink flowers. The flowers grow in clusters. The calyx of the flower is lobed—the petals consist of a large erect backward-curving standard petal, 2 sickle-shaped wing-petals and an incurving keel-petal. The two-valved pod is long and flat with a thickened margin.

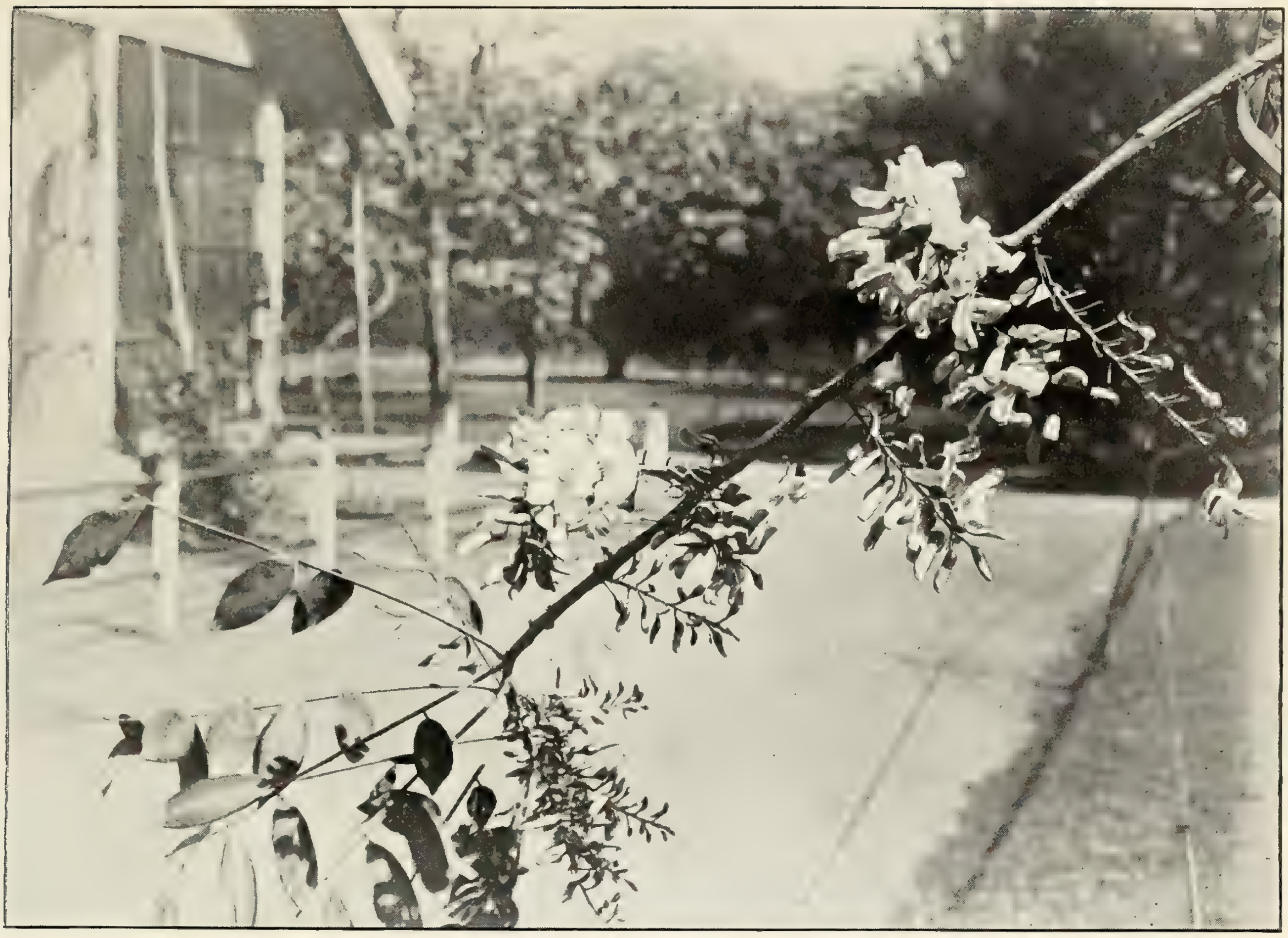
Flowering season.—In Bombay these trees flower in between February and March.

Gardening.—The Spotted Gliricidia is easily raised from seed or cuttings which should be 5-6 ft. long and planted 12 ft. or more apart. The tree bears such a heavy crop of leaves that the branches are frequently broken by the wind, especially as the wood is very brittle, and it is better to pollard the tree from time to time.

Uses.—Macmillan states that the rapid growth of the tree and its long leafy branches recommend it as a useful shade tree for crops and for green manuring. The whole tree is rich in nitrogen, the flowers alone containing up to 3·36 per cent. The dried leaves smell like new-mown hay.

Distribution.—Gautemala to South America. It was introduced into Ceylon from the West Indies about 1899. At a meeting of the Members of the Bombay Natural History Society held on the 29th September 1916, Mr. Millard exhibited a young specimen of this handsome flowering tree which he had raised from seed received from the Peradeniya Gardens through the kindness of Mr. Macmillan, the Curator, and this was probably the first introduction of this tree into Bombay.

[We regret to say that Sister Mary Chionia of All Saints, Mazagon—whose beautiful sketches, signed 'M.C.'—have illustrated many of these articles, passed away on August 14th., 1932. The Society is greatly indebted to her for her beautiful work.—Eds.].



Flowers of the Spotted Gliricidia (*Gliricidia maculata*).

Spotted Gliricidia Tree in the Victoria Gardens, Bombay.

INDIAN DRAGONFLIES

BY

F. C. FRASER, LT-COL., I.M.S., F.E.S.

Part XL.

(With 3 text-figures.)

(Continued from page 656 of Volume XXXV).

(Sub-family: PLATYCNEMINAE—cont.).

Genus: CALICNEMIS Selys, (1863).

Calicnemis, Selys, Bull. Acad. Belg. (2) xvi, p. 159 (1863); Id. Mem. Cour. xxxviii, p. 130 (1886); Kirby, Cat. Odon. p. 131 (1890); Selys, Ann. Mus. Civ. Genov. xxx, p. 502 (1891); Laid. Rec. Ind. Mus. Vol. xiii, p. 322, 326 (1917); Munz, Mem. Amer. Ent. Soc. No. 3, p. 54 (1919); Kennedy, Journ. Sci. Ohio, Vol. xxi, No. 1, p. 27 (1920); Fraser, Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 745 (1923).

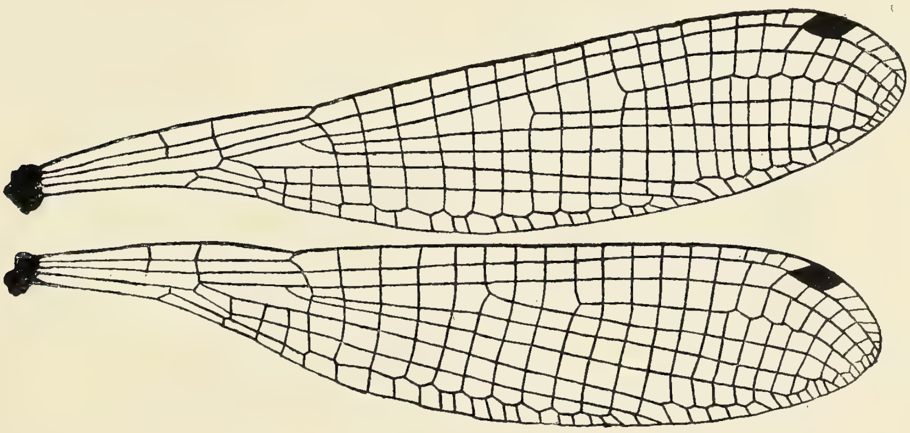


FIG. 1.—Wings of *Calicnemis eximia* Selys ♀.

Dragonflies of rather small size and of moderately slender build, with abdomen less than twice the length of hindwing; coloured red or bright chrome yellow marked with black or more rarely black partially obscured with pruinescence. Wings hyaline, rounded at apices, never falcate, pedicle moderately long: discoidal cell elongate, costal side about three-fourths the length of posterior, distal side at least half as long again as the basal and very oblique so that the cell is acutely pointed at its distal lower angle; sectors of arc arising from lower end of arc and divergent from origin; no accessory basal postcostal nervure present; the nervure *Ac* situated slightly nearer the distal antenodal nervure; *Ab* always present and complete, continued on as *Ia*, which latter extends for about three-fourths the length of wings; petiolation beginning well proximal the level of *Ac*; *Cuii* extending for a short distance beyond the end of *Ia*, 20 cells or more in length; *Riv+v* arising well proximal the level of the oblique nervure descending from the subnode, *IRiii* a little distad of that nervure; pterostigma slightly variable in the species, subquadrate, diamond-shaped, braced; cells of wings mainly quadrangular; 3 cells between the discoidal cell and nervure descending from subnode.

Head narrow; eyes relatively smaller than in species of *Platysticta*; occiput simple; posterior lobe of prothorax rounded and simple in both sexes; abdomen cylindrical, moderately robust and short as compared to species of *Coeliccia*; anal appendages very homogeneous, superiors nearly as long as inferiors, ending in two long branches, one of which simulates a long robust subbasal ventral spine, the other directed straight back to form the apex of appendage; inferiors long, tapering, sinuous, closely resembling those of *Coeliccia.*

Genitalia,—lamina narrowly and deeply cleft; hamules broad quadrate plates meeting across the middle line; lobe flask-shaped, deeply grooved on its ventral surface; penis closely similar to that of *Coeliccia*, the apex dividing into two long curling branches which curve down to embrace the stem of organ. Vulvar scales short, robust. Geno-type: *Calicnemis eximia* Selys.

Distribution.—The genus is almost entirely an Indian one, most species being confined to N.E. India and Burma, but one or more extending into Indo-China. The genus is closely related to *Coeliccia* and *Indocnemis*, differing from the former by its shorter petiolation, broader and more rounded apices of wings, and from the latter by its broader and shorter wings, by possessing only 3 cells between the discoidal cell and nervure descending from the subnode, and lastly by its more open reticulation of wings.

Key to species of genus *Calicnemis.*

Males.—

1.	Beneath head entirely black	... 2.
	Beneath head black marked with yellow ...	... 3.
2.	Head and abdomen black without markings	*C. pulverulans* Selys.
	Head black with citron yellow markings; abdomen with segment 1 yellow, segments 2 to 6 red, 7 to 10 black ...	*C. erythromelas* Selys.
3.	Abdomen bright vermilion red without markings; a small upper posthumeral yellow spot on thorax; face and head as far back as posterior ocellus red without markings	*C. eximia* Selys.
	Abdomen black more or less marked with red or ferruginous; no posthumeral yellow spot or a very tiny one; front of head black or black traversed with yellow or red bands	... 4.
4.	Abdomen black with segments 1 and 2 and base of 3 brick-red or bright ochreous; frons and face black ...	*C. mortoni* Laidlaw.
	Abdomen black from segment 6 to 10, basal segments red; not more than 15 postnodal nervures in forewings ...	*C. miles* Laidlaw.
	Abdomen red with black markings on segments 8 to 10 only; 19 to 20 postnodal nervures in forewings ...	*C. miniata* Selys.

Females.—

1	Beneath head entirely black	... 2.
	Beneath head black marked with yellow. ...	... 3.

2. Abdomen robust, black, dorsum of segments 1 and 2 with yellow markings; labrum broadly bordered with yellow. *C. pulverulans* Selys.
Abdomen slim, segments 1 to 6 yellow, 7 to 10 black; labrum entirely black. *C. erythromelas* Selys.

3. Not more than 13 postnodal nervures in the forewings ... ... *C. miles* Laidlaw.
Not less than 17 to 19 postnodal nervures in the forewings ... ... 4.

4. Head broadly yellow beneath; a conspicuous yellow posthumeral superior spot present ... ... *C. eximia* Selys.
Head black beneath marked with a small wedge-shaped yellow spot; no superior yellow posthumeral spot present ... ... 5.

5. Labrum yellow with a large mediobasal black spot ... ... *C. mortoni* Laidlaw.
Labrum yellow, unmarked ... ... *C. miniata* Selys.

Calicnemis eximia Selys.

Calicnemis eximia Selys, Bull. Acad. Belg. (2) xvi, p. 160 (1863); Id. Mem. Cour. xxxvii, p. 131 (1886); Kirby, Cat. Odon. p. 131 (1890); Selys, Ann. Mus. Civ. Genov. xxx, pp. 502-507 (1891); Laid, Rec. Ind. Mus. Vol. xiii, pp. 327, 338, 330, 331 (1917); Fraser, Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 745 (1923). Martin; Mission Pavie (Nevrop.) p. 18 (1904); Fraser, Journ. Asia. Soc. Bengal. N. S. xix, p. 462 (1923).

Calicnemis atkinsoni Selys, (*eximia* nec *atkinsoni*) Mem. Cour. xxxviii, p. 131 (1886), Id. Ann. Mus. Civ. Genov. xxx, pp. 503-505 (1891); Laid. l.c. p. 327 (1917).

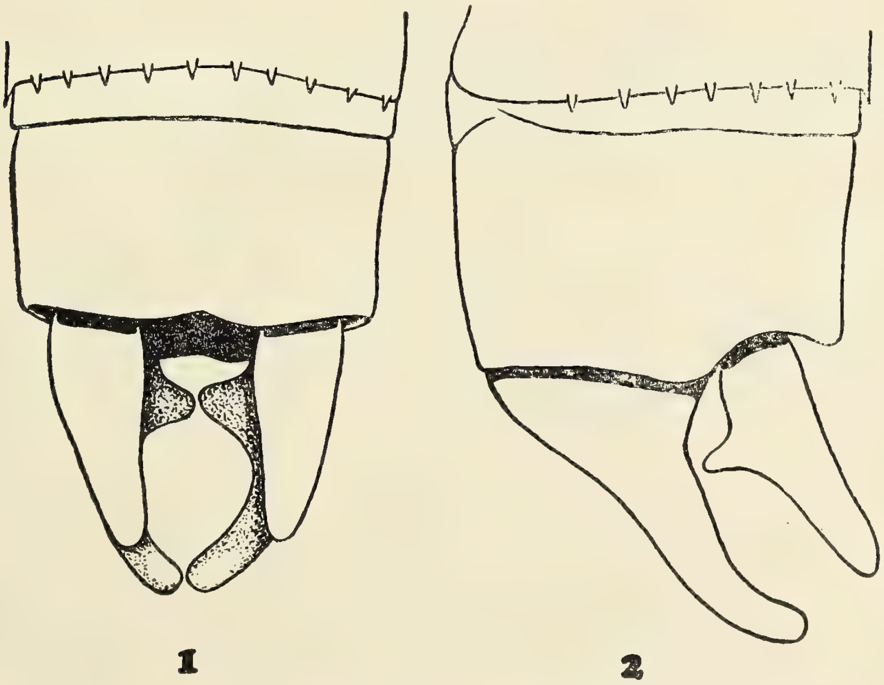


FIG. 2.—Anal appendages of *Calicnemis eximia* Selys, ♂—(1) Dorsal view. (2) Right lateral view. (Camera lucida study.)

Male.—Abdomen 30-34 mm. Hindwing 21-23 mm.

Head.—Labium pale ochreous, labrum, bases of mandibles, genæ and upper surface of head as far posterior as the level of posterior ocelli bright vermilion red, including the antennæ; occiput velvety black with a pale yellow streak behind each eye; beneath occiput black with a broad quadrate pale ochreous patch against each eye; the latter red above paling to yellow beneath.

Prothorax velvety black, bright yellow laterally; posterior lobe rounded, simple, black.

Thorax black on dorsum as far as the middle of mesepimeron laterally, marked with a pair of bright citron yellow or bright vermilion antehumeral stripes with straight inner border, curved outer, extending into antealar sinus; a small yellow spot just behind the upper end of humeral suture; laterally bright yellow with a narrow black oblique stripe mapping out each postero-lateral suture, tapering to a point below, beneath yellow.

Wings hyaline; pterostigma reddish brown framed finely in yellow, braced, slightly longer than broad, 14 to 17 postnodal nervures in forewings, 13 in the hind, 3 cells between the discoidal cell and the oblique nervure descending from the subnode in forewing, 2 to 3 in the hind.

Legs vermilion, unmarked. Abdomen bright vermilion red throughout but becoming a little darker or brownish in old specimens, entirely without markings. Anal appendages bright yellow, slightly longer than segment 10, and of equal length; superiors of the generic shape, acute at apex and with a long subbasal spine; inferiors a little sinuous, apex turned abruptly upwards.

Female.—Abdomen 28 to 30 mm. Hindwing 23 to 25 mm.

Differs in several respects from the male, a more robust insect, the wings extending almost to end of abdomen; ground-colour bright citron yellow instead of vermilion; abdomen dark enfumed ochreous changing to black on the terminal segments, segment 1 yellow with a small wedge of dark colour at base, segment 2 with the middorsal carina narrowly or broadly black according to age, or blackish brown in very old specimens; some obscure paired apical spots on segments 7 to 9 in some specimens but these obscured in the full adult stage; head differing from male by a black band traversing the vertex and frons, of variable width, sometimes narrow but in others broadening at the middle portion; wings rather broad, 17 postnodal nervures in the forewings, 16 in the hind; pterostigma of the same colour as the male, usually broader, about one-fourth as long as broad, but variable in this respect even in the wings of individual specimens; legs yellow or ochreous, femora black on extensor surface, especially at the distal ends.

Anal appendages yellow or dark brown, conical, short, pointed; vulvar scales robust, extending to end of abdomen, yellow.

Distribution.—N. E. India, Bengal, Sikkim and Assam. The author found this species very common at Mangpu, Darjeeling district, during June and May. It breeds in small brooks flowing through marshes, has a short weak flight and is gregarious.

Type probably in the Selysian collection, paratypes in most Museums including the Indian, Pusa and British institutions. The generalised and vivid red colour of this insect serves to determine it at once from all others of the genus. The female bears a close resemblance to those of *C. miniata* and *C. pulverulans* and is distinguished from the former by being broadly yellow beneath the head instead of wholly black, whilst from *C. pulverulans* the same character as well as the presence of an upper posthumeral spot will serve to separate it.

Calicnemis pulverulans Selys.

Calicnemis pulverulans Selys, Mem. Cour. xxxviii, p. 133 (1886); Kirby, Cat. Odon. p. 131 (1890); Laid. Rec. Ind. Mus. Vol. xiii, pp. 322, 329 and 331 (1917); Fraser, Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 745 (1923).

Male.—Abdomen 31 mm. Hindwing 25 mm.

Head.—Labium white, lateral palps black; labrum blackish brown broadly bordered with yellow; bases of mandibles, genæ and clypeus glossy black; rest of head matt black pruinosed partly as follows—a broad fascia including the basal joints of antennæ extending from eye to eye from front of frons to a line drawn through the interocellar space, after which is a broad belt of black extending from eye to eye followed by a second and narrower belt of pruinescence across occiput dilated at both ends, pale yellow stripes occasionally being seen dimly through the pruinescence; beneath eyes and head black.

Prothorax black, the middle lobe pruinosed bluish, the posterior lobe black, elongate, rounded, projecting back over front of thorax.

Thorax black but appearing blue from pruinescence except the dorsum which is black as far lateral as the middle of mesepimeron and encloses narrow pruinosed blue antehumeral stripes. Laterally the whole of the side bluish except the postero-lateral suture which does not share in the pruinescence; rounded yellow spots sometimes visible on the anterior parts of the mesepimeron and metepimeron; beneath black.

Legs and abdomen black thinly pruinosed, thus appearing bluish, unmarked. Wings hyaline; pterostigma dark reddish brown framed in thick black nervures, covering a little more than 1 cell, braced; 18 postnodal nervures in forewings, 16 in the hind; 3 cells between the discoidal cell and the oblique nervure descending from the subnode.

Anal appendages black, inferiors pale yellow at base and apex; closely similar to those of *C. eximia*, superiors, slightly longer than segment 10, inferiors slightly longer than superiors, the apex turned down and a little in at nearly a right angle.

Teneral males approximate in colour and markings to the female, and it is to be noted that in the full adult stage, all pale markings become obscured by dense pruinescence, thus perpetuating the markings in a bluish colour through which the yellow may be dimly seen.

Female.—Abdomen 30 mm. Hindwing 25-26 mm.

Resembles the young male and differs markedly from the adult stage of that sex. Labium and labrum similar to the male; bases of mandibles, genæ and a narrow wavy stripe on vertex pale yellow, the latter marking shaped like a cupid's bow and extending from base of one antennæ to the other only; a pair of pale postocular yellow stripes on back of occiput similar to those occasionally seen in the male; *beneath head entirely black.* Eyes black above, dark olivaceous brown below.

Prothorax black with a large hook-shaped yellow spot on each side of middle lobe; posterior lobe very small, rounded, black.

Thorax black on dorsum as far back as the middle of mesepimeron, with a narrow pale yellow antehumeral stripe on each side of dorsum; laterally pale bluish green or pale greenish yellow with a moderately broad black stripe on the postero-lateral suture; beneath pale yellow.

Legs yellow, the extensor surfaces of all femora and the flexour surfaces of tibiæ black, as also tarsi.

Wings hyaline; pterostigma blackish brown, nearly half as long again as broad, covering one and a half cells; 16 postnodal nervures in the forewings, 14 in the hind.

Abdomen deep black throughout except for segment 1 which is pale yellow with a small black dorsal spot, and segment 2 which is mottled or striped with yellow laterally; segments 3 and 4 have also small vestigial baso-dorsal paired yellow spots.

Anal appendages black, conical, as long as segment 10; vulvur scales robust, extending to end of abdomen, dark brown. The abdomen very heavily built in this species.

Distribution.—Northern Bengal, and Sikkim at about 4,000 to 6,000 ft. Moderately common in the hills below Darjeeling from May to September. The male is easily determined from all others by its extreme melanism relieved only by extensive pruinescence. The female more difficult in this respect, is determined by the head entirely black beneath, by the abdomen black beneath as well as on the dorsum, and lastly by the absence of the small posthumeral upper spot which is present in most species. Type, an incomplete male in the Selysian collection. Paratypes in the Indian and British Museums and many private collections.

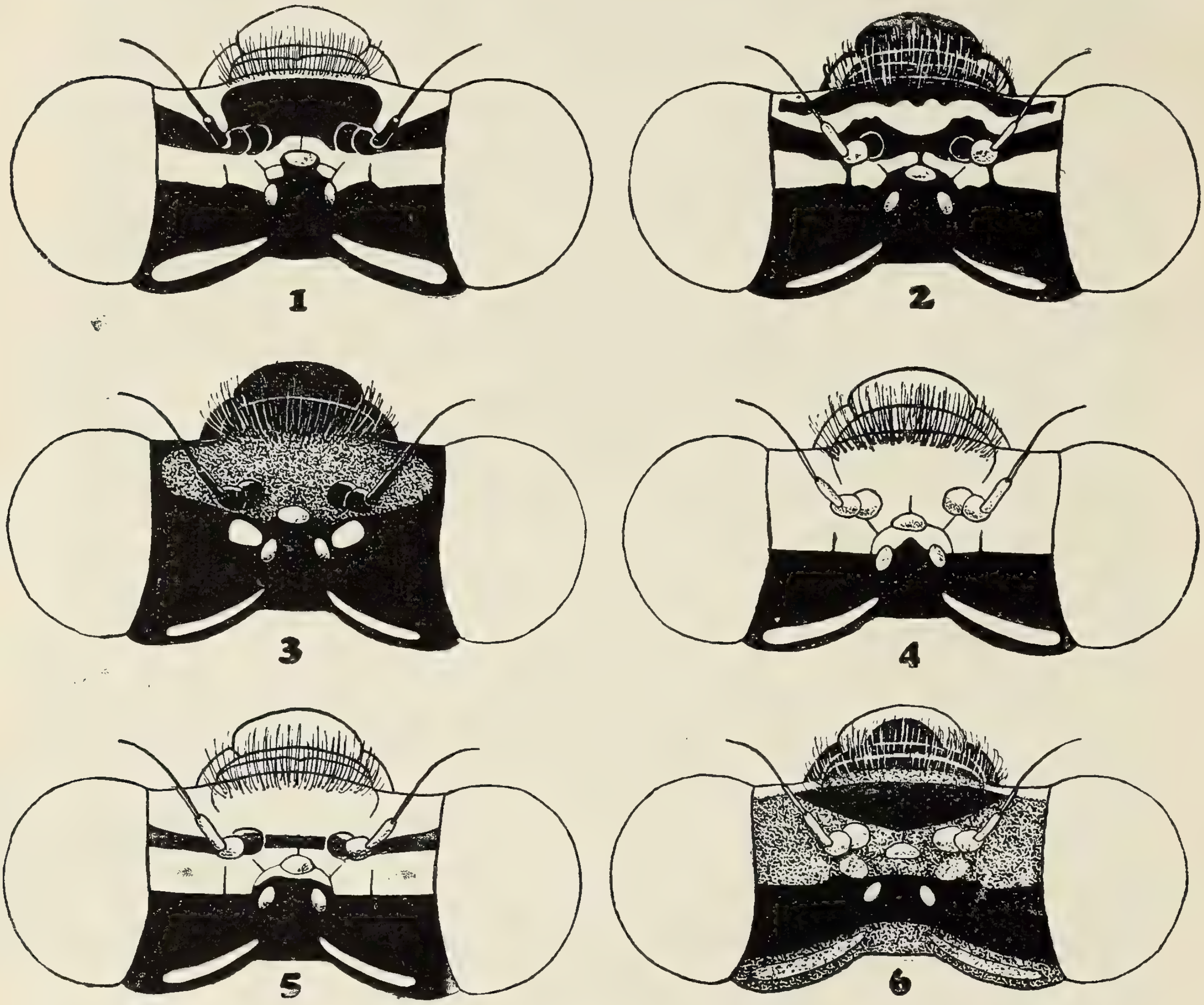


FIG. 3.—Dorsal headmarkings of—(1) *Calicnemis miles* Laidlaw, ♂; (2) *Calicnemis erythromelas* Selys, ♂; (3) *Calicnemis mortoni* Laidlaw, ♂; (4) *Calicnemis eximia* Selys, ♂; (5) *Calicnemis miniata* Selys, ♂; (6) *Calicnemis pulverulans* Selys, ♂ (Shaded markings are pruinosed blue).

CALICNEMIS MINIATA Selys.

Calicnemis miniata Selys, Mem. Cour. xxxviii, p. 132 (1886); Id. Ann. Mus. Civ. Genov. xxx, p. 504 (1891); Kirby, Cat. Odon. p. 131 (1890); Laid. Rec. Ind. Mus. Vol. xiii, pp. 322, 328, 329 and 331 (1917); Fraser, Journ. Bom. Nat. Hist. Soc. Vol. xxix p. 745 (1923).

Calicnemis eximia Selys (*C. miniata* nec *C. eximia* ♀) Bull. Acad. Belg. (2) xvi, p. 160 (1886).

Male.—Abdomen 30-32 mm. Hindwing 25-26 mm.

Head.—Labium pale brown; labrum bases of mandibles, genæ, frons, clypeus and vertex as far back as the level of the posterior ocelli bright brick red, the latter traversed from eye to eye at the level of the antennæ by a narrow black stripe; occiput black marked by a narrow postocular pale yellow stripe on each side; beneath head black with a very small wedge of pale yellow against the eyes; the latter dark brown above, reddish below.

Prothorax black with a large reddish spot on each side of middle lobe; posterior lobe rounded, simple, black.

Thorax black, the dorsum bearing narrow bright red antehumeral stripes, broadening somewhat below, the sides with a narrow yellow or ferruginous stripe in the region of the spiracle and a yellow stripe on the lower half of the metepimeron. These stripes in the adult stage appearing purplish from overlying pruinescence. Beneath pale yellow clouded with olivaceous anteriorly.

Legs dark reddish brown, flexor surfaces of tibiæ ferruginous, trochanters and coxæ yellow, as also the extreme proximal ends of femora.

Wings hyaline; 19 to 20 postnodal nervures in the forewings, 17 to 18 in the hind; pterostigma blackish brown finely framed in yellow and thick black nervures, markedly diamond-shaped and very acute at both ends, braced, covering 1 cell; 3 or 4 cells between the discoidal cell and the oblique nervure descending from the subnode in forewings, 3 in the hind.

Abdomen blood red as far as the basal third of segment 7, remaining segments black; segments 5 and 6 with fine apical black rings. Anal appendages black, shaped very similarly to those of *C. eximia* but the inferiors considerably longer than the superiors, very sinuous and with apices sloping inwards and meeting in the middle line.

Female.—Abdomen 27-29 mm. Hindwing 23-24 mm.

Differs in a few respects from the male, the ground-colour or markings bright citron yellow on head and thorax, ferruginous on the abdomen. Head with the transverse black stripe on vertex much broader, extending forwards onto frons, involving the base of postclypeus more or less, rarely the whole of clypeus black; the stripe cutting off a pale yellow, broadly zigzagged stripe which is often broken up into two spots and incomplete on either side and is situated at the level of the anterior ocellus; markings on occiput and beneath head similar to those of the male. Prothorax and thorax with similar markings but the latter bright yellow laterally marked with narrow oblique black stripes on the postero-lateral sutures. Legs yellow, hinder surface of all femora black and the distal ends of anterior pair brownish; tibiæ yellow on flexor surface, tarsi black.

Wings with 17 to 19 postnodal nervures in the fore, 15 to 16 in the hind; pterostigma longer and less diamond-shaped than in the male, covering rather more than 1 cell, coloured similarly to male; 2 to 3 cells between the discoidal cell and the oblique nervure descending from the subnode in the hindwings, 3 to 3½ in the fore.

Abdomen much stouter than in the male and dilated at the anal end, ferruginous as far as the middle third of segment 6, black thereafter as far as the end except at the sides of segments; segments 3 to 6 with fine apical black rings. Vulvar scales robust, extending slightly beyond end of abdomen, ferruginous; anal appendages black, very minute, pointed at apices.

Distribution.—Bengal and Sikkim, and probably Nepal and borders of Thibet. The author found it moderately common during May and June around Mangpu, Darjeeling district, 4,000 ft. in the Teesta Valley, and has specimens also from Gangtok and Pashoke. The male is distinguished from other species by the whole of the face and upper surface of head bright red except for a narrow black stripe traversing vertex and by the abdomen blood red except for the last four segments which are black. The female is determined with much greater difficulty but may be known by the following complex—labrum wholly yellow, superior posthumeral yellow spot absent or very tiny and inconspicuous, and by the head black beneath with but a small wedge-shaped yellow spot against the eyes, almost obsolete in adults.

Calicnemis miles Laidlaw.

Calicnemis eximia race *atkinsoni* Selys, (*C. eximia* ♀ nec *atkinsoni*) Mem. Cour. xxxviii, pp. 131, 132 (1886).

Calicnemis atkinsoni Selys, Ann. Mus. Civ. Genov. (2) x, pp. 503, 505 (1891).

Calicnemis miles Laid. nov. nom. Rec. Ind. Mus. Vol. xiii, p. 330 (1917); Fras. Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 745 (1923).

Male.—Abdomen 33 mm. Hindwing 25 mm.

Head.—Labium pale brown; labrum, bases of mandibles, genæ, clypeus, the anterior border of frons narrowly and the vertex bright brick red, the latter traversed by a broad black stripe extending from eye to eye at the level of the interocellar space, and forwards at its middle two-fourths nearly to anterior border of frons; antennæ black; occiput and beneath head black, the former with a short postocular pale yellow stripe, and the latter with a diffuse pale greenish yellow stripe extending in from border of eyes; eyes reddish brown above, paler yellow.

Prothorax black with a small yellow spot on each side of middle lobe; posterior lobe simple, rounded, black.

Thorax black on dorsum as far back as middle of mesepimeron, marked with a bright brick-red narrow antehumeral stripe of almost even thickness throughout; no upper posthumeral yellow spot; laterally pale yellow with a broad black stripe overlying the postero-lateral suture; beneath pale yellow.

Legs ferruginous, posterior surfaces of femora darker, flexor surfaces of tibiæ black, as also tarsi.

Wings hyaline; pterostigma elongate, rhomboidal in shape, nearly twice as long as broad, pale reddish brown framed in thick black nervures, covering one and half cells, braced; 14 to 15 postnodal nervures in forewings, 12 to 13 in the hind; 3 to 4 cells between the discoidal cell and nervure descending from the subnode in forewings, 3 in the hind.

Abdomen blood-red except for segment 1 which is pale greenish yellow with a large brown spot on dorsum, and segments 8 to 10, segment 8 with a narrow lateral black stripe, 9 with a large black subdorsal spot at its base, extending nearly to apical border, and 10 with a similar spot but much shorter and bordering its base; all segments with narrow black apical annules, broadening on segment 7, narrow on 8 to 10.

Anal appendages dark reddish brown, the inferiors pale at base; superiors about as long as segment 10 and markedly shorter than the inferiors, shaped as for the geno-type, the inferiors with the apices turned down abruptly and rather sinuous.

Female.—Abdomen 31 mm. Hindwing 25 mm.

Differs markedly from the male as follows—labrum bright yellow; labrum with a tiny black point at the centre of its base, the head otherwise similar to the male except that the markings are bright citron yellow and the spot under the head is quadrate and much larger; prothorax and thorax with the antehumeral stripes and ground-colour laterally bright citron yellow, the lateral spot on prothorax larger, and the black stripe, on sides of thorax narrower and incomplete below; posterior lobe of prothorax similar in shape to the male. Legs bright yellow, only the femora marked with black posteriorly.

Wings very similar to the male, the pterostigma paler and with a fine frame of yellow lining the enclosing black nervures within; 13 postnodal nervures in the forewings, 11 in the hind; 3 cells between discoidal cell and the oblique nervure descending from the subnode.

Abdomen bright yellow clouded with brown or reddish brown on dorsum, becoming black on segments 8 to 10, more broadly so at base of segments 8 and 9; segment 1 with a small black dorsal spot at extreme base; segments 2 to 7 with narrow bright yellow basal annules narrowly interrupted on mid-dorsum, and with the middorsal carina blackish brown and confluent on each segment with a narrow black apical ring.

Anal appendages very small, barely as long as segment 10, dark reddish brown, conical, surmounting a yellow conical protuberance; vulvar scales yellow, extending for a short distance beyond end of abdomen.

Distribution.—Upper Burma and Sikkim. The type comes from Sikkim and is presumably in the Selysian collection. It is named by Selys as *C. atkinsoni* from a ♀ thought by him to be a race of *C. eximia.* The female in question however turned out to be the female of *C. eximia* itself hence a new name became necessary for the male named *atkinsoni*, that of *C. miles* being given by Laidlaw. The above descriptions have been made from a pair taken *in cop* at Gokteik, Upper Burma at the end of May and now in the author's collection. The male closely resembles that of *C. miniata* but is easily distinguished from it by the larger yellow spot beneath the head and by the red colour of abdomen extending its whole length with some black spots on the last 3 segments only. A ready means of distinguishing the two species however is the much lower nodal index, 14 to 15 only in *C. miles* as contrasted with 18 to 21 in *C. miniata*. Females are distinguished by the dorsal black markings much reduced and restricted to the last 3 segments, the lower nodal index and the very large quadrate spot beneath head. The elongate pterostigma in both sexes is also very characteristic as compared to the lozenge-shaped organ found in *C. miniata.*

Calicnemis erythromelas Selys.

Calicnemis erythromelas Selys, Ann. Mus. Civ. Genov. (2) x, pp. 505, 506 (1891); Laid. Rec. Ind. Mus. Vol. xiii, p. 331 (1917); Fraser, Journ. Bom. Nat. Hist. Soc. Vol. p. xxix, p. 745 (1923).

Male.—Abdomen 28 mm. Hindwing 22.5 mm.

Head.—Labium with the middle lobe bright yellow, lateral lobes jet black; labrum glossy black; bases of mandibles bright citron yellow narrowly bordered with black; genæ bright citron yellow with a large central black spot confluent medially with the clypeus which is also black; frons and vertex bright citron yellow with a very irregular crenated bar of velvety black traversing the latter from eye to eye at level of antennæ, the yellow stripe behind it very narrowly interrupted in the middle line; occiput and beneath head matt black, the former with narrow postocular citron yellow stripes on each side; no markings beneath head; eyes black above, olivaceous beneath.

Prothorax velvety black with a large citron yellow spot on the subdorsum of middle lobe and another on each side; posterior lobe rounded, simple.

Thorax velvety black on dorsum as far lateral as the middle of mesepimeron and marked with a narrow bright citron yellow antehumeral stripe on each side; laterally yellow to greenish yellow with a moderately broad complete black oblique stripe overlying the postero-lateral suture; tergum spotted with yellow, beneath palest yellow.

Legs black, the inner surfaces of femora and outer surfaces of tibiæ yellowish.

Wings hyaline; pterostigma dark reddish brown finely framed in yellow and thick black nervures, inner border straight, outer oblique, nearly twice as long as broad, poorly braced, covering one and a half cells; 18 to 20 postnodal nervures in the forewings, 17 in the hind; 3 cells between the discoidal cell and the oblique nervure descending from the subnode in the forewing. Petiolation beginning much nearer the anal crossing than in other species. especially in the hindwings.

Abdomen bright blood red from segments 2 to 6, segment 1 citron yellow with a large black dorsal spot extending to apical border; segments 7 to 10 entirely black, the others very finely ringed with black at the apical ends.

Anal appendages black; superiors acutely pointed at apex which is bevelled strongly within, and with a robust ventral subbasal spine directed straight down, equal in length to segment 10. Inferiors of the same length as superiors, curving out and then slightly in, apex with a minute tooth within.

Female. Abdomen 30 mm. Hindwing 23 mm.

Very similar to the male, of very slender build compared to other females of the genus, the abdomen however markedly dilated at segments 8 to 10. The stripe on vertex more extensive and partially obscuring the yellow band behind it so that the latter tends to become broken up into spots; prothorax, and legs not differing in any respect from the male; wings with 18 to 19 postnodal nervures in the fore, 15 to 17 in the hind; 2 to 3 cells between the discoidal cell and the oblique nervure descending from the subnode in all wings; pterostigma similar to that of male.

Abdomen with segments 2 to 6 bright ochreous tinted with red on dorsum; segment 1 and segments 7 to 10 yellow and black respectively as in the male; the middorsal carina of all segments from 2 to 6 narrowly black but broadening on the last, whilst that of the former has a cross-bar near the apical border and all segments have narrow black apical rings.

Vulvar scales robust, jet black, extending slightly beyond end of abdomen; anal appendages black, shorter than segment 10, conical, pointed.

Distribution.—Type, in the Selysian collection, is a male from Leito; others from Copabo and Mt. Karen, Burma, May and June.

The above description has been made from a pair taken in the Chin hills in November. This species differs from others by its extreme slimness and narrower wings and is quite the most beautiful of the genus. It is distinguished by the alternating bars of black and citron yellow on the head, by the head unmarked beneath, by the isolated yellow spot on prothorax, by segment 7 entirely black, by the shape of the pterostigma and lastly by the anal appendages being of the same length. The female is at once distinguished by its long graceful slim abdomen which contrasts so strongly with the robust build of other females of the genus. Other features are the head entirely black beneath, the alternating black and yellow bars on the head, isolated spots on prothorax and by the striking colouration of the abdomen. The shape of the pterostigma appears to ally it to *C. miles* which is also from Burma.

Calicnemis mortoni Laidlaw.

Calicnemis mortoni Laid. Rec. Ind. Mus. Vol. xiii, pp. 526, 527 (1917).
Fraser, Journ. Bom. Nat. Hist. Soc. Vol. xxix, p. 745 (1923).
Calicnemis inglisi Fras. MSS.

Male.—Abdomen 33-36 mm. Hindwing 26-29 mm.

Head.—Labium black, bases of palps bright yellow; labrum, bases of mandibles, genæ and clypeus glossy black, rest of head matt black, the area between the ocelli and antennæ behind and the front border of frons in front purplish from a thin pruinescence overlying it; a small oval ferruginous spot on each side lying between the posterior ocelli and roots of antennæ; a short narrow pale yellow postocular stripe on each side of occiput and a rather broad flameshaped yellow fascia running inwards from the border of the eye on under side of head.

Prothorax black with a broad thinly pruinosed purplish fascia on each side of middle lobe, and two small ferruginous spots above this.

Thorax black as far posterior as the antero-lateral suture, beyond which the sides are purplish black from thin pruinescence; a narrow slatey blue antehumeral stripe on each side of dorsum confluent with the lateral purplish area on prothorax; the anterior ends of mesepimeron and metepimeron olivaceous yellow; beneath black with a small geminate spot at the middle and a continuation of the yellow of anterior end of metepimeron crossing the anterior end.

Legs black; wings hyaline; pterostigma blackish brown finely bordered with yellow and thick black nervures, covering 1½ to 2 cells, braced; 20 to 22 antenodal nervures in forewings, 16 to 20 in the hind.

Abdomen black, segments 1 and 2 and the base of 3 with dorsum bright ochreous or brick-red, this colour extending partially round base of segment 2 as a narrow ring; segments 3 and 4 with obscure paired apical ferruginous spots.

Anal appendages black, the inferiors tipped with yellow internally. Superiors digitate, slightly longer than segment 10, directed straight back and furnished with an elongate tooth or spine near the base; inferiors much longer, broad at base, then tapering, cylindrical, slender and sinuous, the apices turned abruptly down at a right angle.

Female.—Abdomen 30 mm. Hindwing 25 mm.

Differs considerably from the male as follows—Labium entirely yellow; labrum yellow with a large medio basal black spot; anteclypeus yellow with the outer ends and the postclypeus black; genæ, bases of mandibles and frons yellow; a broad black stripe traversing the vertex at level of antennæ, narrowing to outer side of these organs and broadening forwards between them so as to partly overlap the frons; this stripe followed posteriorly by a narrow yellow stripe at level of ocellar space and narrowly interrupted at its middle; occiput and under side of head black with the usual postocular stripes and a broad quadrate yellow spot against the eyes beneath head; eyes dark brown above and olivaceous below, the two areas sharpy limited at the level of the black stripe crossing vertex.

Prothorax black, middle lobe broadly yellow at sides: posterior lobe broadly rounded. Thorax black on dorsum as far lateral as the antero-lateral suture, marked with narrow citron yellow antehumeral stripes; the sides yellow with a broad black stripe lying along the anterior border of the postero-lateral suture incomplete below. Beneath yellow. Legs black, coxae and trochanters, and the proximal two-thirds or three-fourths of flexor surfaces of femora bright yellow. Wings similar to male; pterostigma covering 2 cells, usually 2 rows of cells between the costa and radius after the pterostigma; 19 to 21 postnodal nervures in forewings, 18 to 19 in the hind.

Abdomen black, segments 1 to 5 bright ochreous on the dorsum deepening to ferruginous and finally black at the apical end of segment 5, the middorsal carina finely black on all these segments and narrow black annules at the apical ends of segments 2 to 5; segments 3 to 6 with small paired subdorsal basal annules pale yellow.

Anal appendages short, conical, pointed, black; vulvar scales robust, black tipped with yellow, extending to beyond end of abdomen.

Distribution.—Sikkim. Pashok, 5,500 ft. and Gangtok, 5,000 to 6,000 ft. during May and June. The type, a male in the Indian Museum, comes from the former locality and has lost most of its markings and the whole of the pruinosed ones from greasing, which accounts for the difference between the original and the present descriptions, the latter having been made from a pair from Gangtok which have retained the original colours and markings in great perfection. Distinguished from other species by the abdomen wholly black save for the dorsum of the basal three segments which are brick red. The female resembles that of *C. pulverulans* closely but the higher nodal index and the yellow marking beneath head will serve to distinguish them from each other. Related to *C. erythromelas* and *C. miniata* by the high nodal index, close venation and dark colouring. Allotype female in the author's collection, as well as a paratype male.

(*To be continued.*)

NOTES ON INDIAN BATRACHIANS.

BY

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(*With 10 plates and 2 text-figures*).

Introduction.

The observations in this paper originated in a discussion over the length of the period of development of tadpoles of the common Indian Bull-Frog (*Rana tigrina*), which led me to solve the problem by actual experiment.

Once I took up the subject, it became so fascinating that I carried my observations further than I had originally intended, and was stimulated to do so by the paucity of the information on the life-histories of Indian frogs. As a boy I had frequently attempted to rear tadpoles, but failure, due to insufficient knowledge of the subject, was invariably the result. About six years ago, when the discussion, referred to above, took place, I tackled the subject once more and only after repeated failures, I eventually succeeded. I am fully conscious of the incompleteness of the observations here recorded, but I submit them in the hope that this short paper will stimulate others to follow up this very fascinating subject.

Much has been written on the different species of Indian Batrachia, both from the viewpoint of the Systematist and the Anatomist, but, as is generally the case, comparatively little appears to have been done from the angle of the Field Naturalist. A glance at the *Fauna of British India* Reptiles, by Boulenger, soon shows us how little was known about the different species beyond their systematic position. The *Records of the Indian Museum* contain a considerable amount of information. Dr. G. A. Boulenger, the late Dr. N. Annandale, and Mr. Narayan Rao, have all contributed much towards the study of Indian Batrachians. Nevertheless, in spite of their efforts, there still remain innumerable gaps to be filled in, particularly in connection with the life-histories and habits of the various Indian species, which naturally involves a study of the tadpole stages. It is frequently too difficult to rear tadpoles to the 'frog stage', on account of their delicacy, and very often, even when they have developed thus far they are very difficult to identify. In this paper it is my intention to place on record such information, as I have been able to accumulate over a period of six years of continuous work during the monsoons, and after.

As a preliminary to my observations, I submit a few remarks on the methods I adopted and a few notes on the rearing of tadpoles.

COLLECTING AND REARING TADPOLES.

Collecting.—The best time to collect is at the break of the monsoon, just after sufficient rain has fallen to bring the frogs out of their hot weather retreats (of course, this will depend much on the locality).

At such times I used to set out, armed with numerous old tins and bottles, and carefully collect the fresh spawn or larvæ (these frequently develop in a few hours) and as carefully convey them home. On no account close or stopper the receptacle containing the larvæ or the tadpoles or they will surely die from suffocation. I found it necessary also to change the water in the containers as frequently as possible, to prevent the captives dying *en route* for want of oxygen. Fresh eggs do not matter so much as there is usually sufficient time to get them home safely. On arrival home, the eggs and larvæ were gently transferred to larger containers. My 'aquaria' consisted of empty tins, basins, in short, anything that would serve the purpose. Owing to a small and usually empty purse, I had to content myself with such 'aquaria'. A disused bulb enema served me both for emptying the 'tanks' and for aërating the water. This I usually did two or three times a day. Aquatic plants were also used for the same purpose, but owing to the 'aquaria' being usually of metal they did not do too well owing to the absence of sufficient light.

Each container was properly labelled with the name or the number of the adult frog preserved in spirit, the date when the spawn was obtained, and the locality. As development proceeded one or more specimens were preserved at intervals of one, two, or more days (in some cases at intervals of hours), this being governed by the number of specimens I had. The tadpoles were examined both alive and dead under a dissecting microscope. An eye was kept on all living specimens both during the day and during the night. Unfortunately, owing to my official duties, I was unable to give them sufficient time during the hours of daylight, except on Sundays and holidays.

Adult frogs were also kept under observation in cages constructed of old boxes covered over with wire mesh, and were also studied in the field.

It must be indicated clearly that my observations are based entirely on data derived from specimens which have been carefully reared. No specimens of spawn have been considered for the purposes of this paper, unless the adults were obtained with the spawn (unless otherwise stated). It is very important that one should be quite sure of the species to which the spawn or tadpoles belong. Random collecting of tadpoles and frogs found in the neighbourhood was therefore avoided, as the writer was fully aware of the difficulties besetting the identification of immature frogs and tadpoles.

To collect spawn or tadpoles at random and to assign them to the different species because of their presence in the locality leaves much room for error and is a method to be condemned. Tadpoles caught in the field should be reared until the 'frog stage' is reached and then kept some time longer before being preserved for identification. This gives time for the teeth to be formed which is an aid in the determination of the species. Even so, the identification of immature frogs is a very difficult proposition.

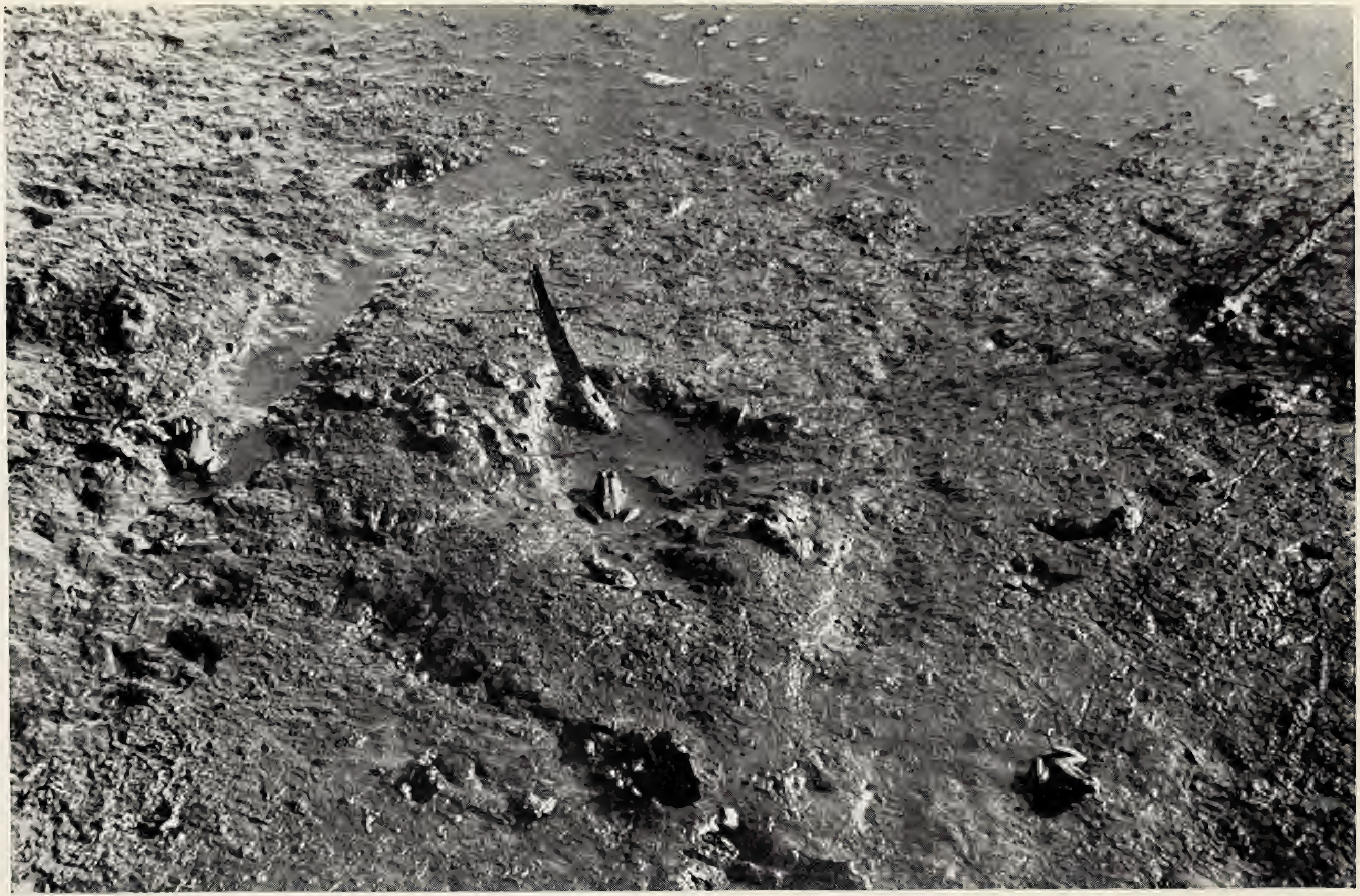
The rearing of tadpoles.—The rearing of tadpoles has frequently presented a knotty problem to those desiring to study them. Though they can survive a considerable time without food, they cannot do so indefinitely. When food is scarce, cannibalism is resorted to and the stronger prey on their weaker brethren. I tried all possible methods of feeding them before I was able to hit on something that was really satisfactory. However, my suggestions are not the last word on the subject and I am sure there is still much room for improvement.

In the rearing of tadpoles there are three important points that require attention, (*a*) *the correct food*, (*b*) *well aërated water* (though in some cases they prefer stagnant water), (*c*) *that no carnivorous insect larvæ are present in the rearing 'tanks'*. Even the larvæ of mosquitoes are detrimental to the small tadpoles. I have seen a fully developed mosquito larva catch and kill a tadpole two centimetres long; while the tadpoles of only some species of frogs feed readily on mosquito larvæ.

(*a*) *Food.*—The best food I have found for tadpoles is raw meat. The ideal way of providing it is to suspend a small piece of meat tied to a thread just below the surface of the water (not too deep). Should there be a large number of tadpoles in the same container it is advisable to put in two or three such pieces, in this way all the competitors get a chance, and there is no danger of one tadpole eating another's tail for want of opportunity to get at the meat. In some instances dead insects and live snails also serve as food. Animal matter alone is not sufficient. This should be supplemented by green vegetable matter, such as algæ and water weeds. This is best done by introducing such water plants as *Hydrilla*, *Ceratophyllum*, *Nias*, the common Duck weed, *Lemna*, or *Valianeria*, known as the Tape- or Eel-grass. But in doing so it is very important to guard against the presence of the larvæ of carnivorous insects.

(*b*) *Water.*—Under no circumstances should the water be allowed to become too foul. This is most detrimental to tadpoles. Oxygen is very essential. Water plants are of the greatest use here, provided the aquaria are in well lighted positions otherwise the action of the plants is reversed. They will deprive the water of oxygen. A good way of aërating aquaria without having to purchase expensive apparatus is to use a bulb enema or something similar—it suits the purpose well. It is advisable to aërate small aquaria at least twice a day. A sure sign that the aquaria need aërating is when the tadpoles all rise to the surface and remain there. The water in small aquaria should be changed at least once in two days. In the alternative, part of the water should be drained off and replaced with a fresh amount. When changing water it is best to strain it through a cloth to prevent the tadpoles from escaping. A syphon is not advisable as the tadpoles pass through the tube or get stuck in the mouth. Straining them through

Plate I.



The Water Skipper (*Rana cyanophlictis*, Schneid.) in slush, its most common habitat.

Photo by C. McCann.

a cloth in no way injures the tadpoles, provided that they are not kept too long out of water. After straining them through a cloth they should be put into a small receptacle till the containers have been washed and then carefully returned to the aquaria. Care should also be exercised when pouring fresh water into the aquaria—the flow should be very gentle as the tadpoles are likely to be damaged.

(*c*) *Carnivorous insect larvæ.*—This point needs special attention. Great care should be taken when introducing water plants into the aquaria to see that no aquatic insect larvæ are put in along with them. Dragonfly larvæ are particularly to be guarded against as they are especially dangerous to the tadpole life in the aquaria. Many such larvæ are coloured like the weeds and are easily overlooked. On one occasion I lost the greater part of a fine set of tadpoles owing to the presence of a dragonfly larva which I could not detect, until it was almost too late.

Another point that may be mentioned here is that all the tadpoles of one batch do not develop at the same rate and it very often happens that the larger ones prey on the smaller. In such cases it is advisable to separate them.

With regard to the general habits of frogs I have found it extremely difficult to decide whether certain species are diurnal or nocturnal. During the dry season most of them certainly appear to be nocturnal, however, this is easily explained by the fact that frogs possess a humid skin, cannot stand long exposure in the hot sunlight, but during the rains and in wet localities I have found them about both day and night. For example *Rana cyanophlictis* is both diurnal and nocturnal when it lives in tanks and swamps and it also undertakes long journeys by night during the dry season. *Rana tigrina* appears to be nocturnal during the dry season while during the rains it is both diurnal and nocturnal—but even during the early monsoon it retires should there be long hours of sunshine. *Rana breviceps* on the other hand is truly nocturnal both during the rains and during the dry season. I only quote these instances to show how difficult it is to decide this point.

In conclusion I wish to express my thanks to Dr. Malcolm Smith of the British Museum for very kindly identifying most of my material, to Mr. Salim A. Ali for some of the photographs he has taken for me and to Mr. C. C. A. Munro of the British Museum for the identification of the leeches referred to in connection with this paper.

RANA CYANOPHLICTIS Schneider.

The Water Skipper.

The English name indicates a characteristic habit of the frog which can move over the surface of the water in a series of short leaps.

This species is perhaps our commonest frog; met with at all seasons of the year, wherever there is sufficient water. It is almost purely aquatic and both diurnal and nocturnal. It is the commonest frog too, in tanks, pools, and streams, whether temporary or perennial, clear or stagnant. I have also found them in cisterns in which the water was soapy. In Thana I have seen them in abundance in open gutters where the water was very foul and full of kitchen refuse, often discoloured with saffron and currystuffs, but the frogs did not seem to mind it. When hot water exuded from the drains the frogs just moved away and returned when the water cooled—adaptation to environment! One sees it frequently on the banks of streams but it certainly has a predilection for still water where it can leisurely float on the surface. This character, coupled with its peculiar habit of *skipping* over the surface of the water when alarmed, readily distinguishes it from any other species. I know of no other frog that is capable of performing this feat, though it has been attributed to *R. limnocharis* and *R. hexadactyla.* Annandale[1] has rightly pointed out that *R. limnocharis* is quite incapable of performing this feat and that *R. hexadactyla* does so but quite feebly on account of its large size. *R. cyanophlictis* appears to have a liking for sunshine, for it may be seen even during the hottest part of the day, floating on the surface of water.

If alarmed, when sitting on the bank, it will leap into the water and 'skip' along the surface for some distance and then float; but if this precaution is insufficient to avoid the danger it just 'skips' along a little further. If already in the water it will either 'skip' away or, if still threatened, nose dive to the bottom into the mud. There it partially buries itself leaving only its two eyes above the mud, in a position to keep an eye on the actions of the intruder. Although aquatic, the frog cannot remain under water for very long. After a few minutes it cautiously reappears on the surface. Its two eyes and the tip of its snout first show themselves above the water, much after the fashion of a crocodile; the rest of the body dangles under the surface. If not disturbed, it will rise once more to float on the surface.

The Skipper Frog is an extremely active creature and is as much at home on land as in the water. During the day it rarely strays far from water, except during the monsoon months when it is found almost anywhere. There appears to be no doubt that this species does undertake long journeys during the night, it would be difficult otherwise to account for its sudden appearance in water holes which have been recently excavated.

During the period of aestivation, I believe that it buries itself deep in the mud of tanks, and there tides over the dry season, but with regard to this point I have no personal experience.

These frogs call, at almost any season, at any time of the day, though they are certainly more vocal during the monsoon, both day and night. The voice resembles a somewhat low pitched rattle, much like the unbroken rattle of castanets or 'bones', kept up for a short while. The sound is produced by two bluish-white, obovoid vocal sacks which are first inflated gradually and then slowly, but not completely, deflated. This may be done when the frog is at rest on the bank or when it is floating on the surface of water. Any one familiar with the vocal productions of frogs is easily able to recognise its distinctive call.

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[1] *Rec. Ind. Mus., Vol.* xv, p. 122 (Bombay Streams Fauna).

This frog is a very voracious feeder, and is able to secure its prey both above and under the surface of the water. Its food consists of insects, little frogs and it is largely responsible for the destruction of a great number of tadpoles and insect larvæ, particularly when these come to the surface to take air. To test this, I kept a specimen in a deep jar and introduced a number of tadpoles into the water. As soon as the frog saw them, without the slightest hesitation, it immediately dived under the surface and swallowed the tadpoles one by one using its forelegs to hasten the meal.

The spawn is laid in pools and tanks at the break of the monsoon, but it is possible that this thoroughly aquatic species may breed at any time of the year in suitable localities.

Though I have not so far come across the spawn, I have repeatedly taken tadpoles of this species and reared them to the frog stage. The tadpoles are very pugnacious and attack one another. The victors feeding on the body of the vanquished. In the earliest stage the eyes are placed on the side of the head but appear to creep to a more dorsal position as the tadpole develops.

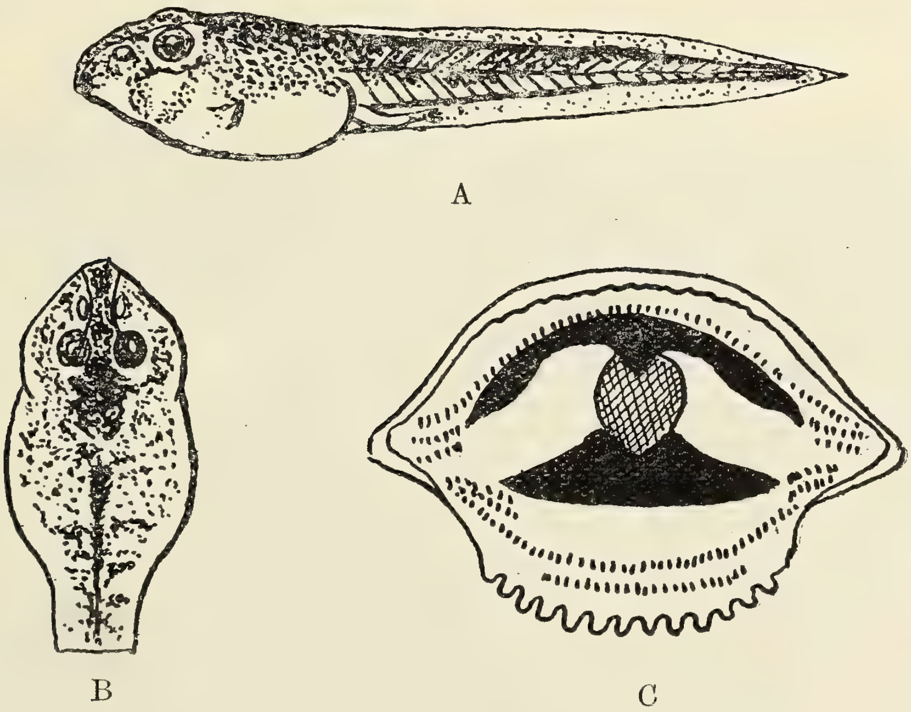

FIG. 1.

Rana cyanophlictis, Schneid. A. Tadpole ×2. B. Dorsal view of figure A. C. Lips and horny teeth. The cross-lined portion indicates the palatine plate.

The largest specimen of a tadpole with the hind legs fully developed measured 44 mm. This specimen was taken in a cistern at Sion, Bombay Island. Annandale and Narayan Rao[1] in a paper on the '*Tadpoles of the Families Ranidæ and Bufonidæ in the Plains of India*' give the measurements of two specimens of this species, one from the Chilka Lake and the other from Kashmir. They respectively measured 65 mm. and 71 mm.—one about half and the other more than half again larger than the one measured by me. This seems to show that the tadpoles of this species may vary considerably with the locality, though it must be indicated that my specimen was reared under artificial conditions. A young frog, six hours after leaving water and after completing its metamorphosis measured 17 mm. The tail was almost completely absorbed, leaving only a very small stump which did not protrude beyond the length of the animal.

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[1] *Rec. Ind. Music*, Vol. xv, p. 31.

Young frogs, when they have completed their metamorphosis, leave the water and sit about on rocks and stones for a considerable time, only resorting to it when danger threatens. In this way they sit about for three or four days without feeding, after which they eat greedily.

Judging from comparison, I am inclined to believe that this species takes from three to four years to reach maturity.

The tadpoles of this species devour mosquito larvæ. Mosquitoes were totally unable to breed in the containers in which these tadpoles were kept, whereas they bred freely in some of the other containers.

RANA TIGRINA Daud.

The Indian Bull-Frog.

The Bull-Frog, the largest of the Indian frogs, may be met with at almost any time of the year in wells and tanks. Under these conditions its colouring is sombre brown. Some examples have a pale stripe down the back. Frequently it is mottled with darker and lighter patches of the same colour (brown) and at times there is a suffusion of dull green and yellow here and there. The under parts are generally white with a pinkish tinge on the lower portions of the thighs. Bull-Frogs living in situations where the water dries up bury themselves deep in the earth soon after the rains have ceased and reappear again at the break of the next monsoon. During the period of æstivation a number of them congregate in the same hole. Aestivating frogs have frequently been found twenty and thirty feet below the surface of the earth, particularly when wells are being dug. It is probable that they go deeper in search of moisture. Frequently, disused rat holes are used for the purpose. During the dry season, a frog which has taken shelter in one of these burrows may occasionally be enticed to leave its retreat if sufficient water is poured down it. It will then come up and sit at the entrance of the burrow and take a look round, but conditions not being quite what it was given to expect, it soon pops in to 'sleep' again. This experiment may be repeated and the frog will respond each time—probably it gets swamped out—whatever the causes the result is always the same. Many of the Bull-Frogs which appear from their dry weather

The Indian Bull-Frog (*Rana tigrina*, Daud.) in a pool at the break of the rains.

Photo by C. McCann.

The Indian Bull-Frog (*Rana tigrina*, Daud.)

Photo by S. A. Ali.

retreat are a pale lemon yellow. At the break of the monsoon they are to be heard and seen all over the countryside congregated about tanks and ponds. The lemon yellow raiment is the wedding garb of the males of this species. What is it that brings about this striking change in their colouring? It has often been thought that the yellow colour was due to the darkness or absence of light in their retreats during the long period of aestivation. If this were the case, why is it that only the adult males are so coloured? The females and the young males are the usual sombre brown yet they have lived under the same conditions. Here we have a point which explodes the theory of light action. If the colouring were due to the action of light alone, the females and the young males ought to be of the same yellow colour as the adult males!

I am unable to offer any explanation of this most interesting question. The fact remains that the adult males alone are yellow. Beside this characteristic, the males possess another mark of distinction in the shape of a pair of large vocal sacs, one on either side of the gape (below). These are coloured a vivid cobalt blue. Boulenger and Annandale[1] in a note entitled '*Further Observations on Rana tigrina*' state the following:—'Males with white or grey external vocal sacs on each side of the throat'. This may be so in preserved specimens, but it is certainly not the case in the living frog, the vivid colouring of the vocal sacs persists even for a considerable time after the breeding season. The sacs are inflated and deflated when the Bull-Frog emits its powerful croak. They present a striking contrast to the yellow of the body. With its vocal sacs each frog is capable of producing an enormous volume of sound which can be heard over a long distance. When there are several scores vying with one another the noise is deafening.

When the frogs first emerge with the break of the monsoon, their primary instinct is that of mating. All the males are in search of wives! For the first three or four days, sometimes for a week or a little more, depending much on the weather conditions these stalwarts dressed in their nuptial attire sit about and croak, all alert and on the *qui vive* for the discovery of a female in their midst. The females make their appearance at the same time as the males. They wear no wedding garment but appear in their sombre work-a-day garb, as such, the female is readily recognised. She sits very close, as if frightened out of her wits, by the great concourse of would-be suitors. As long as she sits still she is safe but the slightest move on her part and she is detected. There ensues a frantic scramble among the males in her vicinity—a battle royal for the possession of the female ensues. The fighting is done with the hind legs. Biting is never resorted to and in all my experience I have never known a frog to bite. This is easily accounted for by the fact that opening of the mouth interferes with the respiration. The competitors kick vigorously. The individual who has secured a bride—and this is generally the one who was closest to her when she was discovered—holds her with his fore legs and kicks his opponents aside if possible.

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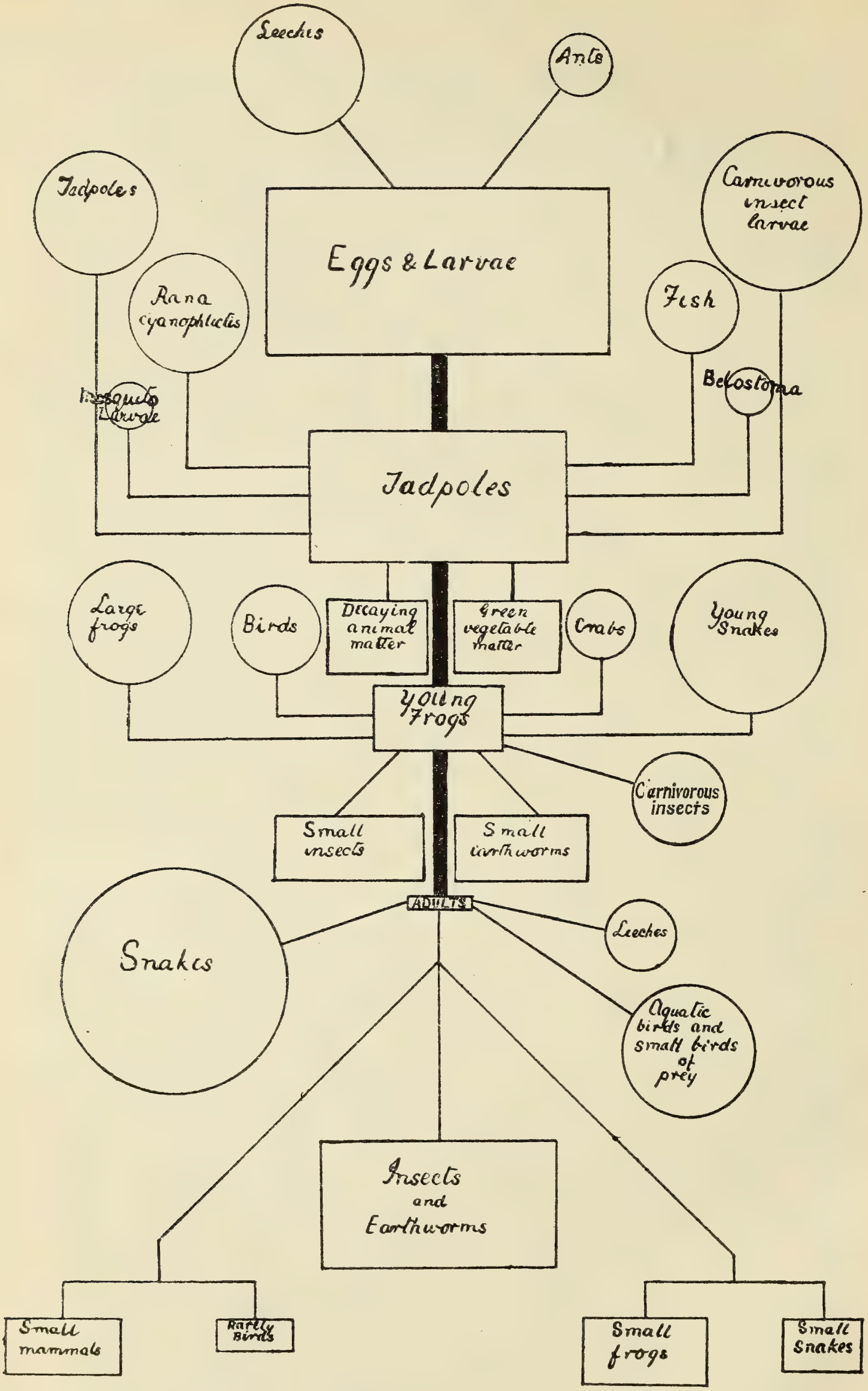
[1] *Rec. Ind. Mus.*, Vol. xv, p. 57.

Not infrequently, however, these all too eager males in mistake seize a dull coloured male, but the error is soon discovered. It must be explained here that in the gathering of males, the brightness or the uniformity of the yellow colouring decreases—there are some which are darker in colour which have presumably lost the freshness of the colouring exhibited by them on emergence. These individuals, as I have stated, are occasionally mistaken for females. The conclusion suggested is that the male is guided mainly by colour in distinguishing the female of the species.

As soon as a male secures a mate his croaking ceases till the next year and, after amplexus is over, the male begins to lose his yellow coat. The yellow first becomes suffused with green and in a few days the males have resumed their usual colouration and are as inconspicuous as the females. Another curious point arises here. The males which remained above ground during the dry season, according to my observations, retain their normal colouring. Specimens kept in captivity by me exhibited no change. Do they take part in the sexual excitement displayed at this period, and do they stand the same chance of obtaining mates? There is no doubt that they croak, but I have never observed one of these males in amplexus. If mating takes place in a tank or a large pond the process is not completed there, but the female still in the grasp of the male will scramble out and make for one of the numerous shallow puddles in the vicinity. Here she discharges her eggs, the male fertilizing them at the moment of extrusion.

The eggs are deposited in small puddles and not in large pools as one might expect. This procedure is very often detrimental to a very large number of eggs, as the puddles dry up and the eggs are destroyed, if there is no rain in a few hours or days as the case may be. Apart from the risk of the eggs themselves drying, ants are responsible for destroying large numbers of them so stranded. Yet I believe, that the provision is a safeguard, as there are fewer enemies to destroy the eggs in such puddles. The eggs are laid singly, and each is surrounding by a transparent jelly-like substance. In this they float about for a time drifting about with the wind till at length a number of eggs become agglutinated together and form one mass. After a couple of hours or so they sink *en masse* to the bottom of the pool. An examination of the mass reveals each egg is enveloped in its own jelly-like substance and united to the main mass by a stalk of the same matter. The eggs with their investments have the form of minute spherical electric lamp bulbs. The upper half of the egg is black and the lower half creamy, the black half is always turned towards the sky. Segmentation is very rapid, the larval stage is soon completed and under favourable circumstances, the tadpoles leave the surrounding slime in about four days. As soon as they leave the slime they come to the surface of the water and remain hanging there, tail downwards, for a considerable time, before they swim about freely. During the period they are enveloped in slime, I have found, in


Leeches
Ants
Tadpoles
Carnivorous insect larvae
Eggs & Larvae
Rana cyanophlyctis
Fish
Mosquito Larvae
Belostoma
Tadpoles
Large frogs
Birds
Decaying animal matter
Green vegetable matter
Crabs
Young Snakes
Young Frogs
Carnivorous insects
Small insects
Small earthworms
ADULTS
Snakes
Leeches
Aquatic birds and small birds of prey
Insects and Earthworms
Small mammals
Rarely Birds
Small frogs
Small Snakes

The Food and Enemy cycles of the Bull-Frog (*Rana tigrina*). The rectangles connected by thick black lines show approximately the proportionate development of the frogs. The other rectangles indicate the food at the different stages of development. The circles show the inimical factors.

certain localities, that the leech, *Hirudo birmanica* (Blanchard) is very inimical to both the larvæ and the young tadpoles. This creature is responsible for the destruction of large numbers of them. It sucks out the larva and a quantity of its investment of slime. A leech, taken after feeding on the larvæ, contained mostly slime and blood in the alimentary canal.

With the continuation of the rain, the tadpoles are swept into the larger pools. Here they go through their metamorphosis. They are preyed upon by fish, other frogs, particularly, *R. cyanophlictis*, who captures them under water, the young of the Checkered-Water Snake (*Tropidonotus piscator*) which also emerges at this time, and last but not least, a host of insect larvæ, among which the dragon-fly and carnivorous water beetle larvæ, not to mention the water bug (*Belostoma indica*) are the foremost. In addition to numerous external enemies the tadpoles themselves are largely responsible for their own destruction as the larger ones prey on their smaller brethren. Cannibalism is rampant among them and there is always a variation in size and numerous smaller ones to be preyed upon as tadpoles of the same set of eggs do not develop at the same rate. When the metamorphosis is completed and the young frogs are ready to leave the water, they make their way into the grass and remain there for the rest of the season till it is time to aestivate. All immature frogs of the previous years are to be found in the grass and in the fields throughout the rains. At this stage they are much more green in colour than the adults. Judging from comparison it takes a bull frog about 6 to 7 years to mature.

The first instinct of the frogs as soon as they appear with the break of the monsoon, is the propagation of the species. When this has been fulfilled their attention is next turned to feeding. The croaking has stopped—there is no time for entertainment. The yellow frogs have *disappeared.* When they first appear they are thin and emaciated after their long fast of nearly eight months, though, I am of the opinion that their thinness is more due to the absence of water, however, in a couple of weeks they look quite healthy.

The food of the Bull-Frog is varied. Insects constitute its chief diet. Small mammals, rarely small birds, snakes and other frogs, lizards, earthworm; in fact any creature that is easily overpowered is included in the diet. Frogs are the prey of numerous snakes and small snakes sometimes over-estimate their powers and fall victims in a foolhardy attempt to seize one of these giants, several times too large for them, notwithstanding the elasticity of the snake's jaws and its extraordinary capacity of swallowing prey exceeding it in calibre. I have watched one of these combats in which the hunter was 'hoist with its own petard'. As the snake tries to capture the frog, the intended victim hops round and faces its antagonist keeping it in 'full view'. He emits a short croak or two and bides his opportunity to pounce on the snake with an agile leap. It seizes the snake in its mouth gripping it anywhere along its length and with the aid of its fore legs, which it uses alternately like two hands it literally stuffs the struggling reptile into its mouth. The process has of necessity to be very rapid as it is well known that a frog is unable to breathe properly with its mouth open.

On another occasion I gave a captive frog a small Buff-striped Keel-back (*Tropidonotus stolatus*), a very common snake in our fields during the monsoon. It was immediately pounced upon and swallowed. The snake bit the frog in several places as it was being swallowed, but this the frog only treated with a flick of its hind leg which soon dislodged the jaws of the snake. Any foreign matter on the back of a frog is immediately dislodged with the hind legs while the fore legs are used for anything that might be on the 'face'. When earth is taken along with food it is ejected and wiped away with the fore legs.

In every case food has to be seen moving and it is only then that it is pounced upon. In fact anything that shows the slightest signs of movement is seized, and if not edible is at once rejected. To test this point I tied a small stone on to a thread and threw it to a Bull-Frog, as it fell it was immediately seized and as quickly rejected. If I moved the stone by drawing the thread the frog pounced on it once more and again spat it out. This performance was repeated several times with the same result. Experience did not seem to teach the frog that the stone was not edible. Anything small that moved was prey and the creature instinctively obeyed the impulse to seize it. When in the act of swallowing the large eyes are always depressed.

Besides the powerful croaking referred to above this frog is able to make another sound which is only uttered when in pain, as when the creature is seized by a snake. It is a loud scream, almost human, which is most uncanny if heard and not recognised. When caught the batrachian inflates itself to bursting point, a common feature with most frogs when on the defence, and then gradually deflates, at the same time making a gentle noise which may be expressed by the word 'kut' repeated several times. The process is repeated by maximum inflation, being followed by gradual deflation to the accompaniment of the sounds described.

The enemies of the Bull-Frog are many. Snakes, particularly the Checkered Water-Snake (*T. piscator*) and the Dhaman (*Zamenis mucosus*) feed freely on these frogs. Among the birds, I have repeatedly seen the Shikra (*Astur badius*) capture them from the water—not to mention the host of aquatic birds. Jackals are said to eat frogs but of this I have no direct evidence.

Bull-Frogs have a very great power of endurance and the following experiment which I tried will illustrate this. A few frogs captured after the break of the monsoon were kept perfectly dry. In three days the animals were bone dry, stiff, and hard, with the exception of the abdominal region which was still a little soft. Their shrunken skins revealed every bone. The abdominal region had caved in under the transverse processes of the vertebræ, the bones appearing quite distinct. The tissues of the body had become so hard in this process of drying up, that when dropped on the table my frogs clattered like so many pieces of wood. Respiration and other functions had entirely ceased and the eyes were completely closed—to all appearances my specimens were quite dead, dead as proverbial door nails. I believed my experiment at an end. However, I left them for another day and on the night of the fourth day I placed them in a tub of water, to see if they would revive. When placed in water they floated on its surface like corks. About twenty minutes later, to my astonishment they began to show signs of returning life. The hind limbs stretched out gradually and sank below the surface of the water, while the rest of the body floated. The valves of the nostrils, which up to this time had been closed, opened by degrees, and the membrane, under the lower jaw, which is constantly in motion during activity due to respiration, began to move again, but slowly, and at intervals. Till immersion it was as dry as the rest of the body. Soon after, the eyes opened gradually, the frogs were able to recognise my presence and made feeble efforts to submerge, they failed only to succeed a few minutes later. They floated listlessly on the surface of the water. But the process of revival continued and an hour after they were put into the tub, they were just able to jump out of it, and after the lapse of four hours the outline of the bones disappeared the fleshy roundness of form was restored and my frogs were quite themselves once more, apparently none the worse for their experience. These frogs I kept for several months before releasing them. The incident strikingly indicates this frog's extraordinary power of endurance, and in some way helps to explain its ability to withstand the rigours of its long period of aestivation.

The Bull-Frog may be kept in captivity for years. It will readily feed on cockroaches, other insects and small mammals and birds, earthworms, lizards and snakes. It will feed on raw meat, small pieces should be suspended from the top of the cage by a thin thread just strong enough to hold the pieces of meat, but not to take the weight of the frog. When the pieces of meat swing about the frogs jump up and take them thread and all.

External parasites.—In the Island of Salsette I have observed a large leech feeding on the larvæ as I have already mentioned above, but this could hardly be considered as a case of parasitism, as the prey was generally completely destroyed. However, I have found the same leech on adult specimens as well.

The most interesting instance of parasitism in connection with the Bull-Frog is that exhibited by a small leech, *Paraclepsis prædatrix* Harding, which, beside attacking the bodies of their host in many cases caused total blindness. The circumstances are worthy of note.

In December 1931, while at Abu Road, Rajputana, I visited a well which I knew to contain many frogs, to catch some of them for study. When I put my net into the well, I noticed that many of the frogs did not pay the slightest attention to it. At first I attributed this to the temperature as it was a very cold morning. Under such conditions frogs do not appear to like to submerge or remain long in the water. However, I dragged some of them up and on removing them from the net to the collecting bag I found that my hand was covered with small green leeches. Even then it did not strike me that the frogs were blind and that the leeches were responsible for their condition. Some of the frogs had their eyes completely closed. I put my first catch into the bag and it was not till I drew up the second lot that I examined the frogs. On examination, I noticed that the frogs were very badly attacked by the leeches. The leeches had lodged themselves under both the upper and lower eyelids. On my arrival home I re-examined the frogs and to my surprise took 27 leeches out of one eye and 14 out of the other of a single specimen! The other frogs also had large numbers in their eyes, but none of them approached the number of the specimen just referred to. The irritation set up under the eyelids by the presence of the leeches probably compelled the frogs to keep their eyes permanently closed. In each case there was generally a discharge of mucus from the eyes and the frogs would occasionally brush their eyes with the fore legs. On dissection of an eye it transpired that the leeches had not gone any further than the eyelids. The eyeball in each case appeared to be somewhat withered and the lustre of the eye, such a common feature of a frog's eye, was completely lost. The pupil was reduced to a fine black spot, not the usual large pupil met with in these frogs.

The problem that now presented itself to me was, how were these animals able to exist in this blind condition? In order to see if they had had any food, I dissected the stomach and the alimentary canal. In almost all the cases both the stomach and the alimenary canal were empty with the exception of a quantity of mucus. Probably these animals would have eventually died of starvation while the leeches relieved them of the little blood that they possessed.

Below I give the measurements of the tadpoles of this species and also such notes as I made at the time, at different stages of their development.

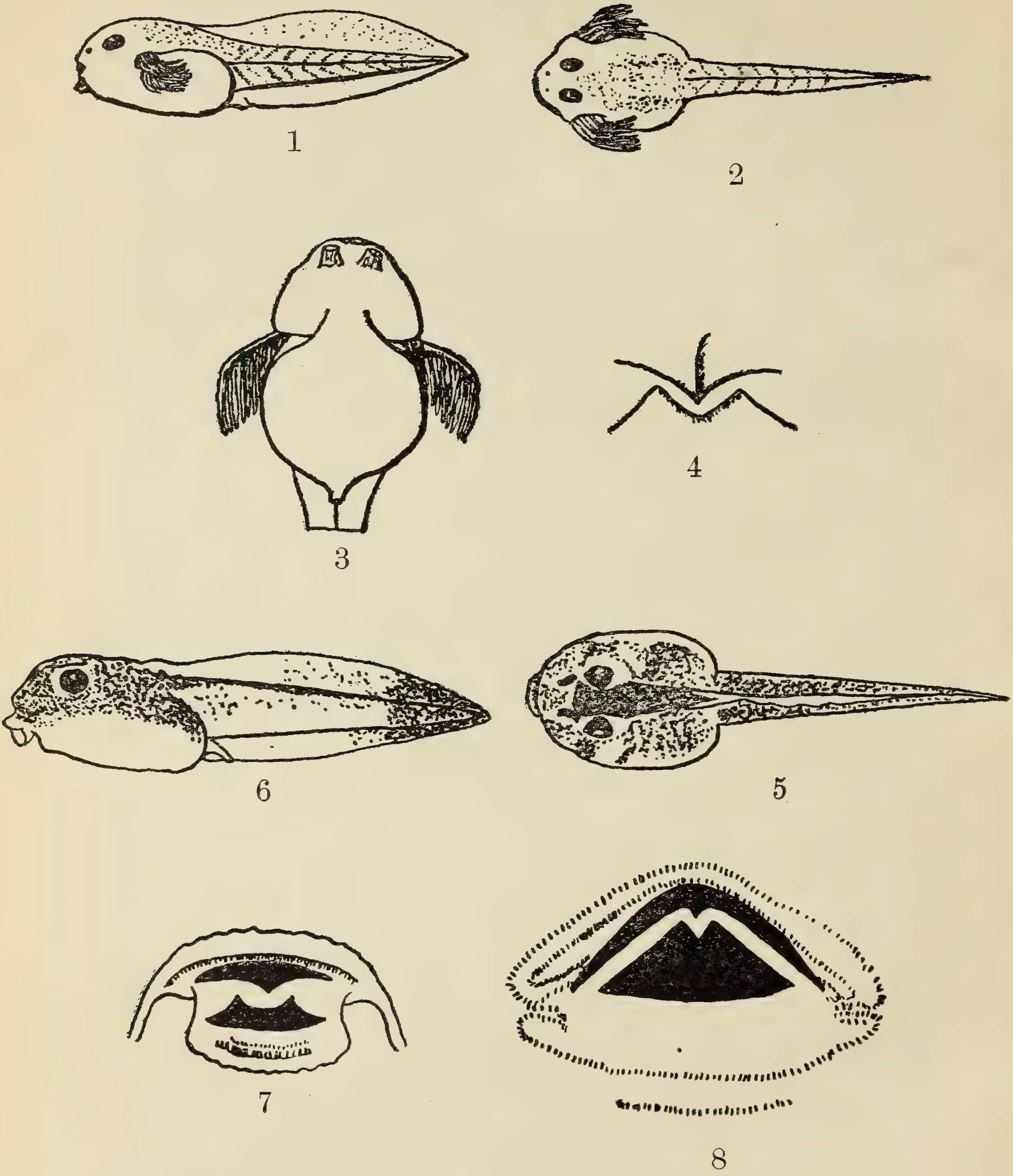
NOTES ON THE DEVELOPMENT OF THE TADPOLES.

On the 9th. of June 1929, I came across a large number of the tadpoles of this species which had only just emerged from the egg stage. At this stage they come to the surface and rest for a time before commencing an active existence. I collected a large quantity and brought them home to study the development and the following is the result:—

9-6-29. Length of tadpole 10 mm. branchial aperture open on either side of the body with the external gills protruding. Three sets on either side. Examination of the mouth showed the beak was but feebly horny, and as far as I could see with a high powered dissecting microscope, no rows of horny teeth were present. At this stage the tadpoles kept to the surface of the water and submerged only when disturbed, only to return to the surface almost immediately. It appears to me that the 'suckers' in some way help to keep them at the surface. The tadpoles were not at all active.

10-6-29. In the same condition as the previous day, but a little more active; swimming about.

12-6-29. Length of tadpole 13 mm. The branchial pores on either side of the body were closed and the external gills had been absorbed. A single branchial pore open on the left side of the body. The beak, much more horny than on the previous day; three rows of horny teeth visible; one above and two below. The upper row extending in a curve across the mouth, lower rows short as shown in Plate IV, Fig. 7. The lips considerably enlarged. The



Del. C. McCann.

Rana tigrina, Daud. 1. Tadpole 10-6-29, ×5, lateral view. 2. Dorsal view of figure 1. 3. Ventral view of figure ×9 to show suckers and external gills. 4. Beak of tadpole figured in figure 1. 5. Tadpole on 12-6-29, ×5. 6. Dorsal view of figure 5. 7. Arrangement of beak and teeth on 12-6-29. 8. Arrangement of beak and teeth on 13-6-29.

'suckers' had completely disappeared. Much more active and moving about freely, though generally near the surface; continually opening and closing the mouth.

13-6-29. Length of tadpole 21 mm. More pigment appeared all over the body, particularly at the extremity of the tail membrane. (a very characteristic feature of the tadpoles of *R. tigrina.*) The beak now almost black. Additional rows of horny teeth developed Plate IV, Fig. 8. A circular horny plate appeared on the palate.

16-6-29. Length of tadpole 28 mm. The tail more acuminate and its extremity more deeply pigmented. The hind limbs appeared as two minute conical protuberances at the base of the tail. On the tip of these conical structures there were four very minute buds representing the digits on each. Further pigment appeared and the teeth became more horny black.

18-6-29. Length of tadpole 31 mm. The pigmentation greatly increased. The conical hind limbs developed further.

30-6-29. Length of tadpole 39.5 mm. Hind legs 5.5 mm. Toes distinguishable. Another tadpole measured on the same day was 45 mm. long. The hind legs fully developed, complete with webs between the toes. Fore legs fully developed and distinctly visible through the skin of the branchial chamber.

4-7-29. Metamorphosis completed. Tail partially absorbed. Beak and horny teeth shed. No teeth in the mouth.

15-7-29. By this time not all of the tadpoles had completed their development.

8-8-29. A young frog that had been kept alive and fed measured 22 mm. long and was fully pigmented. The teeth were feebly developed.

Another set:—

15-6-31. The spawn was laid after some very heavy showers of rain, when it was collected.

16-6-31. The size of the larvæ before they left the slimy envelope varied from 5-7 mm. In colour they were brownish and the surface of the body appeared to be minutely granular. The external gills were in different degrees of development, from conical protuberances to feather-like structures, according to the age of the larva. The suckers were not recognisable in very small larvæ, but were distinct in the larvæ measuring 7 mm. The mouth was represented by only an invagination of the skin at that region. Eyes were not distinguishable. The position of the nostrils was distinct.

18-6-31. Length of tadpole 12.5 mm. External gills completely lost. The brownish pigment of the larval stage disappeared and quite a different type of pigment appeared, in the deeper layers of the skin as blackish dots. The tail membrane which in the larval stage was opaque now became quite transparent. The pigmented region of the tail was marked with reddish-brown spots. The lips were well developed. Beaks and rows of teeth distinctly horny.

20-6-31. Length of tadpole 12.5 mm. In much the same condition as on the 18th. Pigment in the deeper layers more intensified and another type of pigment appeared on the surface like minute black streaks on the upper side of the body, and on the tail.

23-6-31. Length of tadpole 25.5 mm. (This tadpole with two others developed exceedingly fast and were the largest of the group.) Tail became more acuminate. Pigment increased. Beak and teeth well developed. No palatine plate.

26-6-31. Length of tadpole 17 mm. Hind legs began to appear. Terminal portion of tail very deeply pigmented, almost black.

7-7-31. Length of tadpole 32 mm.

14-7-31. Two tadpoles were removed. Length: (*a*) With hind legs partially developed 37 mm. Hind legs 5.5 mm. (*b*) With hind legs almost fully developed 39 mm. Hind legs 16 mm.

15-7-31. One of the tadpoles with all the four legs developed, but which had not left the water measured 39 mm. Hind legs 23.5 mm. Horny teeth and beak shed. Lips absorbed.

On the same day a young frog which emerged from the water and which had completely lost its tail measured 18 mm. from vent to snout. Hind legs 24 mm.

8-8-31. On this day the balance of the tadpoles were bottled. Up to this time not all of them had completed their development. Many of them were still small and legless.

These records however incomplete they may be help to indicate the approximate time occupied by these frogs to complete their metamorphosis—29 days in the first observation and 23 in the second. They also show how irregularly the tadpoles develop, though this was perhaps the more accentuated by the artificial conditions under which development took place. It is obvious from the above that all frogs born during one season complete their metamorphosis well before the end of the rain and no aestivation takes place during the tadpole stage.

It is interesting to note that the tadpoles of this frog, like those of *R. cyanophlictis*, also feed on mosquito larvæ.

Rana limnocharis, Wiegm.

The Streaked Frog.

A very common species abounding in the neighbourhood of tanks and streams, when these are perennial. During the dry season these little animals either collect under stones etc. in damp places during the day, particularly near a spring and come out when the sun has gone down, or they aestivate. During the monsoon they wander far and wide in the grass and may be found both day and night.

At the beginning of the rains or a little before, large numbers collect on the banks of perennial streams and tanks to deposit their spawn. At this time the males, which appear to predominate, keep up an incessant croaking. The croaking commences as soon as it is dusk and only ceases with daybreak, but on dull days during the early monsoon they may be heard throughout the day. The vocal sacs, one on either side of the gape are blackish. The voice is fairly powerful and much resembles the clatter of castanettes in the distance. To produce the sound the abdomen is first inflated, and in deflation fills the vocal sacs with air, in this way the abdomen and the vocal sacs are alternately inflated and deflated.

When alarmed the frogs take to the water and submerge, but only for a short while, very soon they rise to the surface and swim ashore again, seeking shelter in the vegetation. They are extremely active little creatures. Annandale (*l.c.*) correctly observes that this species is incapable of 'skipping' over the surface of water as is the characteristic practice with *R. cyanophlictis* —nor does it float on water like *cyanophlictis*, but rests with the legs hanging down below the surface.

So far I have not come across the spawn nor the tadpoles of this species though I have repeatedly seen them in amplexus at the commencement of the rains.

In common with many other frogs, I have observed large numbers together, aestivating in crevices of rocks and under large stones.

A very common feature of this frog, is the stripe or streak (from the presence of which I have suggested the English name) down the centre of the back. In my opinion this character cannot be relied on as it may vary in width and colour and may even be absent, in the same locality.

Rana rufescens, Boulenger.

The Rufescent Frog.

Of this species I secured several immature specimens. They were found on bare water-washed rocks on the hillsides adjoining the Kune Kathkari Settlement, Khandala, Western Ghats.

The general colour is a deep brown almost approaching the blackish colour of the rocks. The general markings of freshly caught specimens were very indistinct. Certain tracts of colour are well defined. The upper portion of the arms (*humerus*), the upper surface of the thighs (*femur*) and just behind the head the colouring is a bright crimson or brick-red. In some of the specimens the colour of the arms and behind the head has a tendency of forming a continuous patch. This colouring disappears some time after the specimens were put into preservative. Observed under natural conditions these patches of colour appear to break up the form of the frog and give it the semblance of algæ adhering to the rock.

The Rufescent Frog is a squat little animal with little to distinguish it at a glance from the immature form of the next species, *R. breviceps*.

Dr. Smith writing to me about this species says that it is the first time that it has been found so far north. Up to this time it has only been recorded from Malabar.

Rana breviceps, Schneid.

The Burrowing Frog.

A clumsy looking species, nocturnal even during the rains. After dark I found this frog quite common on the roads at Panchgani. Should it chance to fall into water and not be able to get out, it appears very uncomfortable, but nevertheless, it readily submerges if alarmed, but soon reappears on the surface. Specimens kept in captivity fed readily on insects.

This species is in the habit of digging itself in during the day. At Khandala, I found one which had dug itself in almost a foot below the surface.

Rana leithii, Boulenger.

Leith's Frog.

With its digital discs and slender build this species much resembles one of the tree-frogs.

Leith's Frog was not uncommon in the short grass and in the ditches on the hillsides adjoining the Kune Kathkari Settlement at Khandala. In September of 1931, I secured a few of these frogs. To all appearances this frog appears to be diurnal at least during the rains. It was frequently seen hopping about in the grass.

In colour it is a pale brown, almost sandy, with darker markings. The limbs, particularly the hind legs, are transversely banded with dark brown.

In his letter, Dr. Smith stated that up till the time of my securing the specimens sent to him for identification, this species was only known from a single individual in the collections of the British Museum—the type—which was secured from Matheran.

RANA MALABARICA, Dum. & Bibr.

The Fungoid Frog.

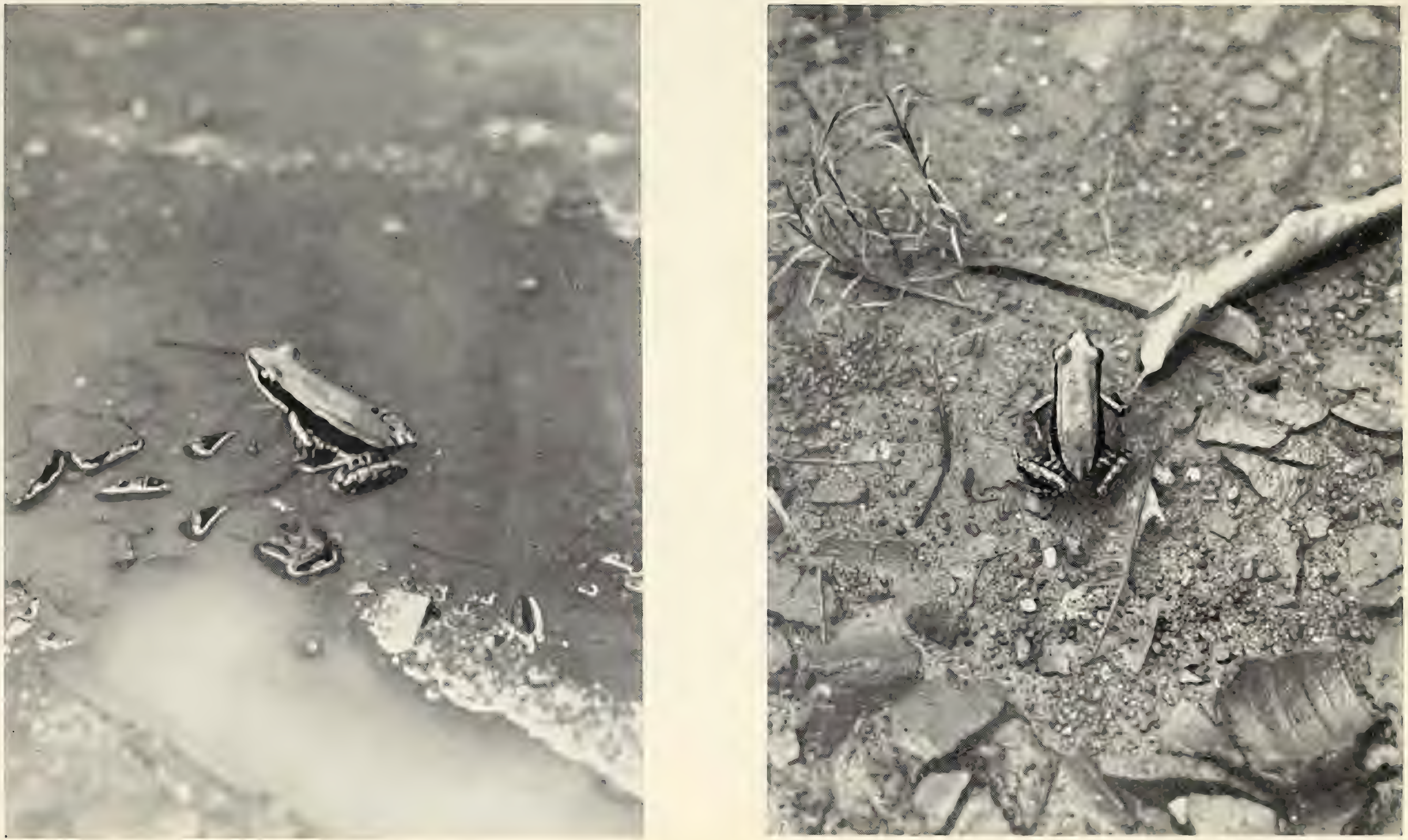
This species is fairly common in the Island of Salsette and at the north end of Bombay Island. It generally inhabits forested areas, but may be seen occasionally in open country. It is terrestrial and semi-arboreal in habit, and is frequently found perched high up on the bark of trees and on the leaves of bushes. In all probability it is a diurnal species as I have often come across it during the day, but have so far not found it about at night.

The colouring of the frog is strikingly characteristic. The dorsal surface, including the head, is brick- or orange-red (sometimes crimson and sometimes in specimens in poor condition, yellowish). A sharp narrow white or yellowish line commencing at the snout, passing from behind the eye to the vent divides the red dorsal surface from a broad greyish black band along the flanks. The dark lateral band passes into mottlings on the under-surface of the frog. Both the hind and fore limbs are transversely, but irregularly barred. The eyes are tinged with bright red and gold. On the whole it is a very handsome creature. When seated on a tree trunk, the colouring on its back gives it the appearance of a red bark fungus as the outlines of its dark flanks are lost against the bark, and its limbs gathered well up under its body are lost to view.

This frog is not at all shy. It sits close, and will allow one to approach quite near and may even allow one to touch it. So like a fungus indeed is the appearance of this frog, so apparent is its reluctance to get away that I have no doubt that the species relies almost entirely on its colouring for protection. I do not mean that the animal is aware of its protecting colours, but the habit of the creature combined with its peculiar colour must enable it to escape detection by such animals that would prey on it.

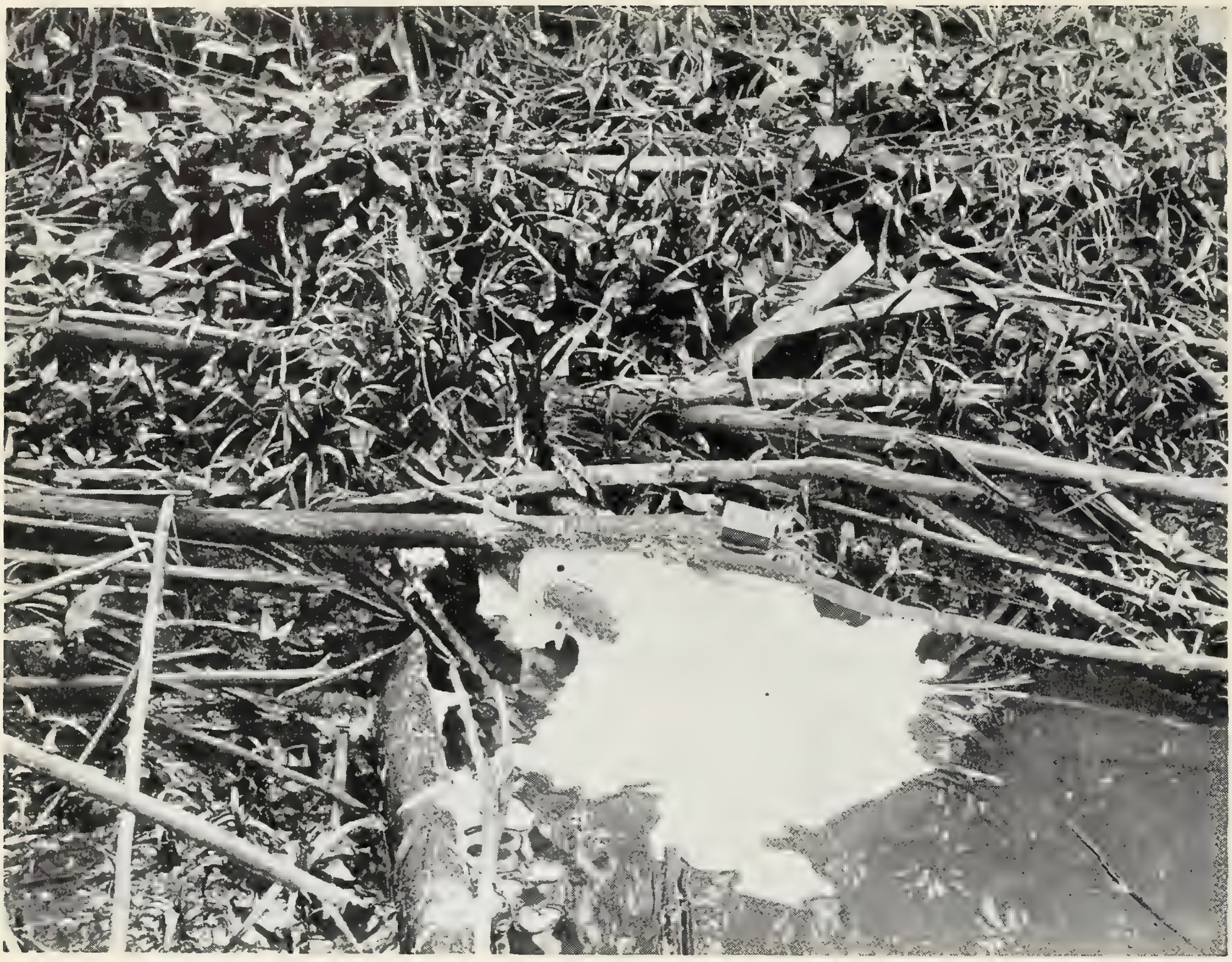
The extremities of the digits are sometimes swollen and adhesive, though they are not so well developed nor have they the same adhesive power as in the case of *Rhacophorus maculatus*—the Chunam Frog.

When handled the call of this frog is not unlike the mew of a kitten plus a sort of high pitched '*kut kut*' repeated several times. I am not familiar with the call at the time of breeding.



The Fungoid Frog (*Rana malabarica*, Dum. & Bibr.) showing dorsal and lateral aspect.

Photos by S. A. Ali.



A spawn mass of the Giant Tree-Frog (*Rh. maximus*, Gunth.)
(*A match box shows it's comparative size.*)

Rhacophorus maximus, Gunth. Another mass of eggs laid in the tangle of twigs covering the water.

Photos by C. McCann.

At the end of the rains (September) I have come across a juvenile specimen which had apparently just completed its metamorphosis but this is no indication as to the period of development for the eggs out of which the particular specimens emerged may have been laid late.

When put into water this frog appears to be very uncomfortable and makes every attempt to get out.

RHACOPHORUS MAXIMUS, Gunth.

The Great Tree Frog.

This species is perhaps the largest of our Indian tree frogs, as its name implies, the Malabar Tree Frog (*Rh. malabaricus* Jerdon) alone approaching it in size. The *Fauna of British India* (Reptiles), Boulenger, p. 472, gives the measurements of this species as 4.5 inches from vent to snout. This measurement is undoubtedly the measurement of a large female. In this frog the difference of size between the sexes is considerable as will be seen from the measurements shown in the table on p. 171.

In colour it is a leaf green above, and white or greyish beneath. The underside of the digits and thighs are frequently tinged with pink. In spirit or formalin the animals turn purple or violet. Its powers of leaping on the ground are not very great. The longest jump measured was under four feet, but there seems to be no doubt that these creatures are probably able to parachute or 'fly' through the air for some distance when a leap is taken from a point that is high up. The Nagas hold this belief.

This frog deposits its spawn in small stagnant pools in the courses of streams. In fact, in all the cases, I found the water, in which the eggs were laid very black and very foul. On the 22nd. of February (1930) while on expedition in the Naga Hills, I was able to observe the breeding of these frogs at a place called Changchang Pani (Tsu), about 500 feet above sea level. Just as it was getting dark I heard the incessant twittering of frogs (the sound was unlike the usual sonorous croak of the Bull-Frog). It was somewhat melodious much resembling the distant tinkling of bells.

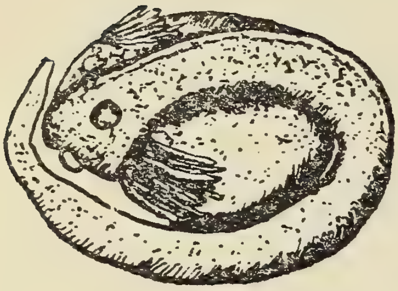
Following the sound I came upon the dry bed of a stream in which there were a number of stagnant pools which had been to some extent replenished by the rain overnight.

Knowing full well that the noise I heard was the production of frogs, I was anxious to investigate the cause of all this hilarity. Soon the reason for the excitement was made evident. The sound was produced by these great Tree Frogs. It was breeding time and the males, which were far in excess of the females, were advertising their presence and were evidently trying to excel one another in the production of 'song'! Many of them had already found mates and were busy depositing their spawn. Once the male secures a mate the couple repair to the nearest pool to spawn. Among the males there is the accustomed quarrelling for the possession of the female. One tries to dislodge the other. The intervener holding the female with his fore legs tries to kick his more successful

Measurements of adult males and females (in millimetres).

	♂	♂	♂	♂	♂	♂	♂	♀	♀	♀
Length from vent to snout	73	73	72	60	81	75	77	108	109	104
Length of hind leg (taken to the tip of the longest toe) ...	106	109	113	91	120	111	113	158	166	165
Length of foot (taken from the tibio-tarsal articulation to the tip of the longest toe)	49	50	50	41.5	55	50	50	71	77	73
Length of longest toe (hind foot)	32	34	33	29	36	34	34	51.5	50	48
Length of longest toe (fore leg)	19	18.5	20	16	18	20	20	31	29	26
Diameter of disc of longest toe of hind leg (The discs are sub-equal)	4	4.5	4	4	4.5	4	4	7	7	6
Diameter of disc of longest toe of fore leg. (This disc is the largest in both the ♂ and ♀)	5.5	5	5	5	5.5	5	5	8.5	8.5	8
Diameter of gape	26	25	26	23	29	25.5	26	39	39	39
Diameter of tympanum	6	6	4.5	5	5.5	4.5	5.5	6.5	7	6
Diameter of eye	7	8	8	8	8	8.5	8	10	10	9.5
Distance of nostril from corner of eye	6.5	7	6	6	8	6.5	8	10	9	9
Distance of nostril from tip of snout	7.5	7	6	6	8	6.5	8	8.5	8.5	7
Head	26	25	23	21	26	24	25.5	35	34	31

In the male the snout is acute while in the female it is obtuse. The discs of the three outer fingers of the fore leg in the female are the biggest while the innermost is about 1/3 their size.



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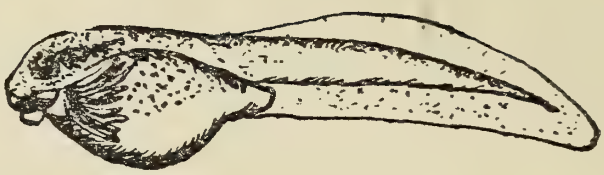

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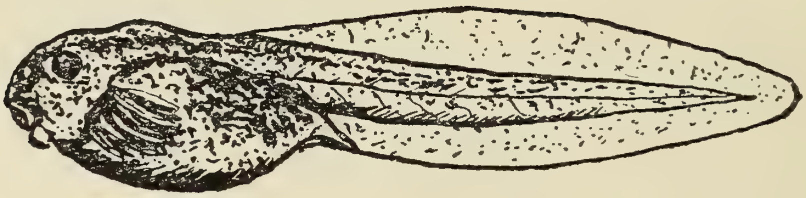

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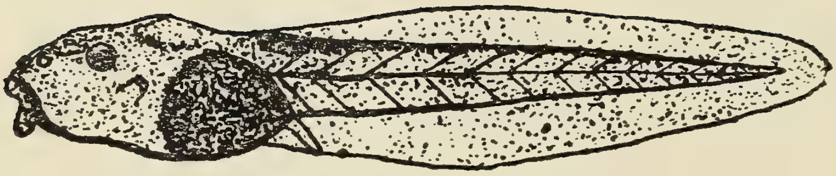

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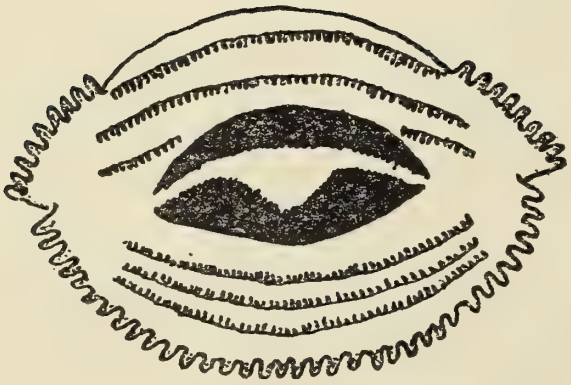

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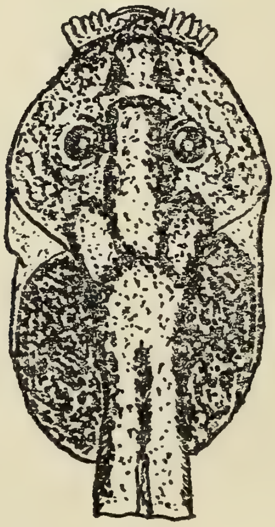

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Del. C. McCann.

Rhacophorus maximus, Gunth. 1. Larva on 26-2-30, ×10. 2. Tadpole on 26-2-30, ×6. 3. Tadpole on 28-2-30, ×6. 4. Tadpole on 3-3-30, ×5. 5. Figure showing the position of the horny teeth and beak. 6. Dorsal view of figure 4.

rival off with his hind limbs.The male in possession takes no active part in the quarrel, he is only concerned with keeping his position. The same tactics I have observed with most of the frogs and toads that I have come across in the breeding season. Once the male has established his right to the female both seek the water. When the egg-laying is commenced no other males interfere with the couple. The male grips the female just behind the armpits but when egg-laying is in progress he slides down a little bit.

To lay her eggs, the female selects a suitable twig and clings on to it with her fore legs, letting the rest of her body hang down quite limp, with the vent a little above the surface of the water (sometimes touching it). In this position she discharges her eggs. The male on his part besides fertilizing the ova, as they are produced, beats up the substance emitted with the eggs with his hind legs, alternately moving his legs up and down. This is how the process appeared to me at the time, but whether frothiness of the spawn 'nest' is really brought about in this way alone, I am still in doubt. If disturbed during the process, both will disappear under the surface of the water together, only to reappear a few moments later, and commence operations anew. After the spawn has been deposited the male releases his hold of the female and she seeks shelter, much exhausted and limp. The spawn consists of a large frothy mass which floats on the surface. In colour both the eggs and the foam are at first white but gradually change to a creamy tinge. A most curious point about these frogs is that the floating mass of spawn is not the produce of a single pair, but a number of females collect and lay their spawn together in a single large mass.

Exposed to the air, the frothy substance, which surrounds the ova, dries and the eggs sinking through the mass reach the surface of the water. This is not the case with all the eggs but with most of them. Under their covering the eggs hatch in about four days. The larvæ are at first creamy white and remain attached to the mass and feeding on it. Here they remain for a few hours and eventually fall to the bottom where they rest for some time occasionally coming to the surface. The colour soon changes to harmonise with the surroundings. These tadpoles in their natural habitat are almost perfectly black.

The next morning I returned to the same spot in order to take photographs of the spawn. Nothing was to be seen of the frogs, but I could distinctly hear them from time to time in the dense undergrowth.

Fortunately the previous evening when observing the adults I had a powerful torch with me and I was able to see the creatures quite clearly in the fading light. The light of the torch did not seem to disturb them at all.

NOTES ON THE DEVELOPMENT OF THE TADPOLES.

22-2-30. Spawn deposited at dusk. Diameter of eggs 2.5 mm. At first white, turning creamy.

26-2-30. The larvæ commenced emerging from the spawn 'nest' in the morning (roughly 84 hours after the eggs were laid). The tail may be curved round the body either to the right or to the left, but the latter appears to be the commoner position. The tail in fully developed larvæ before emergence is arched in a downward direction, but on emergence it soon becomes straight. Two large 'suckers' are present and also external branchæ. The larvae before emergence are microscopically pigmented, but on emergence become much more so.

Length of tadpole on emergence 9 mm. Lips not developed.

28-2-30. Length of tadpole 12.5 mm. External gills well developed. Lips developed. No rows of horny teeth could be seen but the beak was distinctly horny. Tadpoles were very active. Pigment greatly increased—tadpole almost black.

1-3-30. Length of tadpole 14 mm. The external gills commence to be absorbed. In some cases only the remains of the left gill was to be seen at the mouth of the branchial aperture. Topmost row of teeth in the upper lip horny, other rows present but very indistinct. Anus median. Branchial aperture on left side, directed somewhat upwards. Pigment intense.

3-3-30. Length of tadpole 15 mm. External gills completely disappeared. 'Suckers' partially absorbed. Rows of horny teeth well developed. No palatine plate present.

Unfortunately owing to a change of camp my observations have to remain incomplete as I lost all the tadpoles in transit.

RHACOPHORUS MACULATUS Boulenger.

The Chunam Frog.

This is quite a common species in the Islands of Salsette, at the north end of Bombay Island and in the Ghats during the rains. A single male was caught in the compound of the Prince of Wales' Museum by Mr. Jacob this year (1932). It appears with the break of the monsoon. In some localities it also enters houses and is attracted to the light. A common perch of this frog, when it enters houses, is the top of windows and doors, where it is very often accidentally crushed.

At the break of every monsoon since 1927 I have obtained specimens of this species in the cisterns at the Kanari caves, together with the spawn.

The leap of this frog is considerable for its size. When jumping it appears as though it were parachuting through the air. One specimen which I attempted to catch jumped across from the top of one side of a cistern to almost the bottom of the wall on the opposite side. The cistern is about seven feet square and almost the same depth. The extent of the leap was about 9 feet! On the ground these frogs are not able to make such long jumps. Though able to swim well they never live in water, and are, in fact, very uncomfortable when forced to remain in this element. Under such condition the frog floats listlessly with its body parallel with the surface.

The colouration changes according to immediate environment and these changes are somewhat rapid, usually blending with the ground on which the frog is resting. When placed on white cloth or glass the creature becomes almost white with no markings visible. The same appears to be the result when kept in the dark, but as soon as it is exposed to light it simulates the surroundings. However, I have never seen it change to green—the change of colour ranges only between white, yellows, and light browns. When placed in spirit the markings become very distinct.

When resting, all four legs are well drawn up under the body so much so that only the outline of the head and body is seen. This character coupled with the rapid change of colour is undoubtedly of a protective nature, rendering the animal almost invisible. On the whole it is not a very active frog. Reluctant to move it will sit for hours in one place. One that I had free in my room did not change its position during the whole day and remained where it was through the night to all appearances fast asleep.

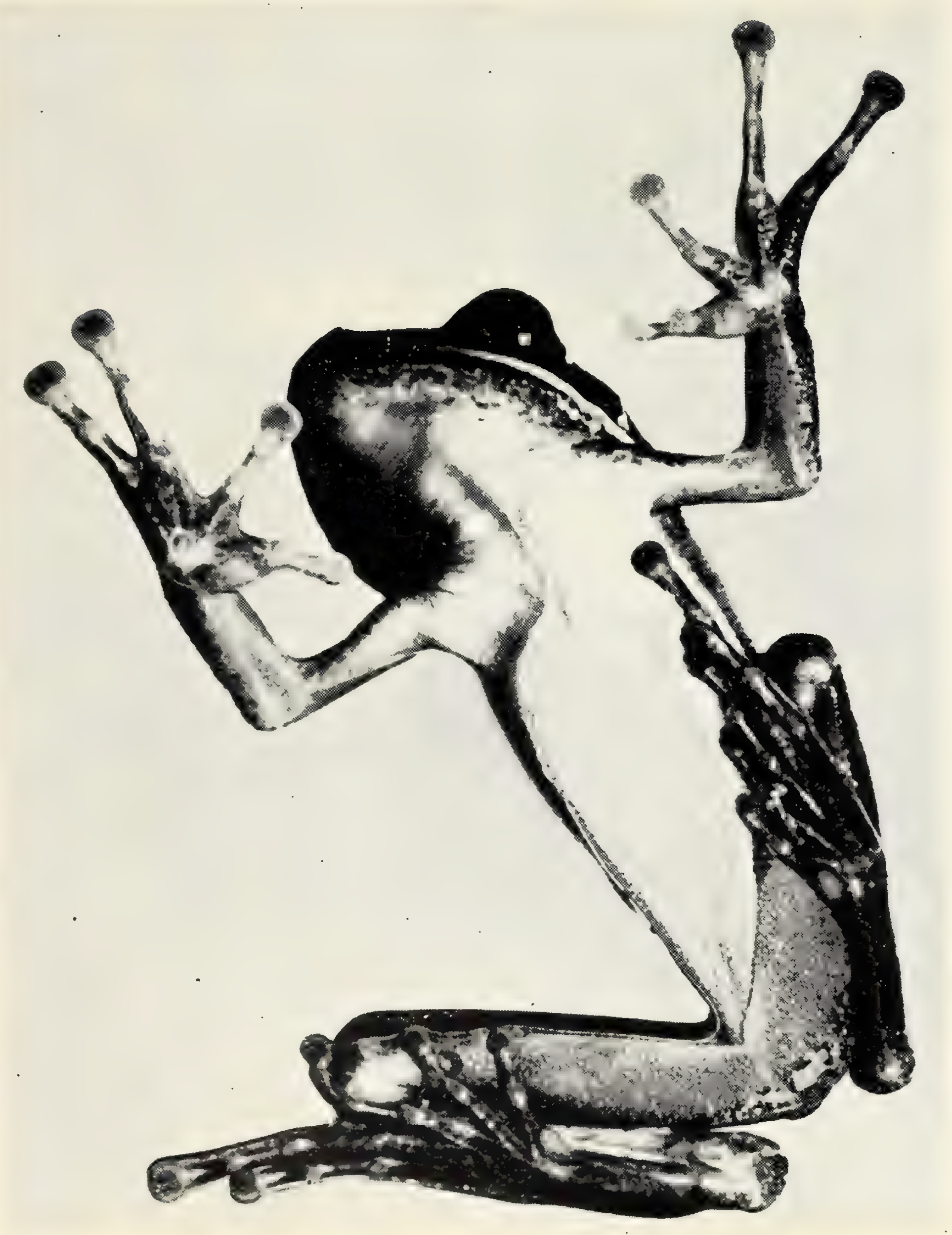
So far I have never come across this species in amplexus. In my opinion the male does not necessarily take part in the production of the spawn 'nest' as I have observed with *Rh. maximus*. My reason for doubting this is based on the fact that I once obtained a female at the beginning of the monsoon and kept her in a jar. During the night to my astonishment she deposited her spawn 'nest' on a small piece of a branch which had been put in as a perch. This specimen is seen with her 'nest' in Plate VIII. I put the 'nest' into water and a few days later tadpoles emerged! One point emerges from this accidental discovery. How and when were the ova of my captive female fertilized? So far as is known, the ova of frogs are fertilized by the male the moment they are discharged. In the present instance no male was present when the female spawned. Yet the eggs were fertilized and tadpoles merged from them. I have considered the problem from various aspects and can only offer one solution. In the present species amplexus takes place, but it is probable that the sexual products of the male and the female are not discharged simultaneously. The male's sperms if deposited on the dorsal surface of the female may remain *there* till she is ready to discharge her eggs and when she does so the sperms pass into the foam containing the eggs and fertilize them. However, this can only be proved by microscopical examination. My captive female, I am convinced, must have carried the sperms on some external part of her body. In no other way could her ova have been fertilized. Is there a reason for the departure from the normal? If there is one, it must be associated with some peculiarity in the habit of the species. Some peculiarity which requires a departure from the methods of fertilization customary with frogs. The explanation which presents itself to my mind is that the peculiarity may be due to the peculiar spawning habit of the female of this species. Her ova or spawn 'nest' is always deposited, not on the surface of the water, but at some height above it, in a situation where the tadpoles on emergence fall into the water below. The 'nest' is frequently discharged on the terminal leaves of overhanging branches, on perpendicular surfaces of rocks, on the walls of cisterns and sometimes under stones. All of the situations in which the necessity of supporting a male on her back at the time of spawning would be inconvenient, if not impossible to the female. Hence the species may have developed the habit of amplexus before the actual discharge of the ova, the male depositing the sperms on the female and she discharging her ova subsequently. I put this explanation forward as a theory not as an observed fact. So little is known about the breeding habits of frogs that there is a great deal of room for further investigation and one of the problems that still require to be investigated is this interesting incident in the breeding habits of the present species.

On every occasion that I visited the Kanari Caves, at the break of the monsoon I have always found spawn 'nests' hanging from the walls of cisterns, sometimes as many as three or four in the same cistern. I have also found these 'nests' on the branches of bushes overhanging water and also on sloping rocks in the open. On the 29th of July (1928) I found a fresh 'nest'. This shows that this species may even lay later than the break of the monsoon. However, this is a point that may vary with the locality.

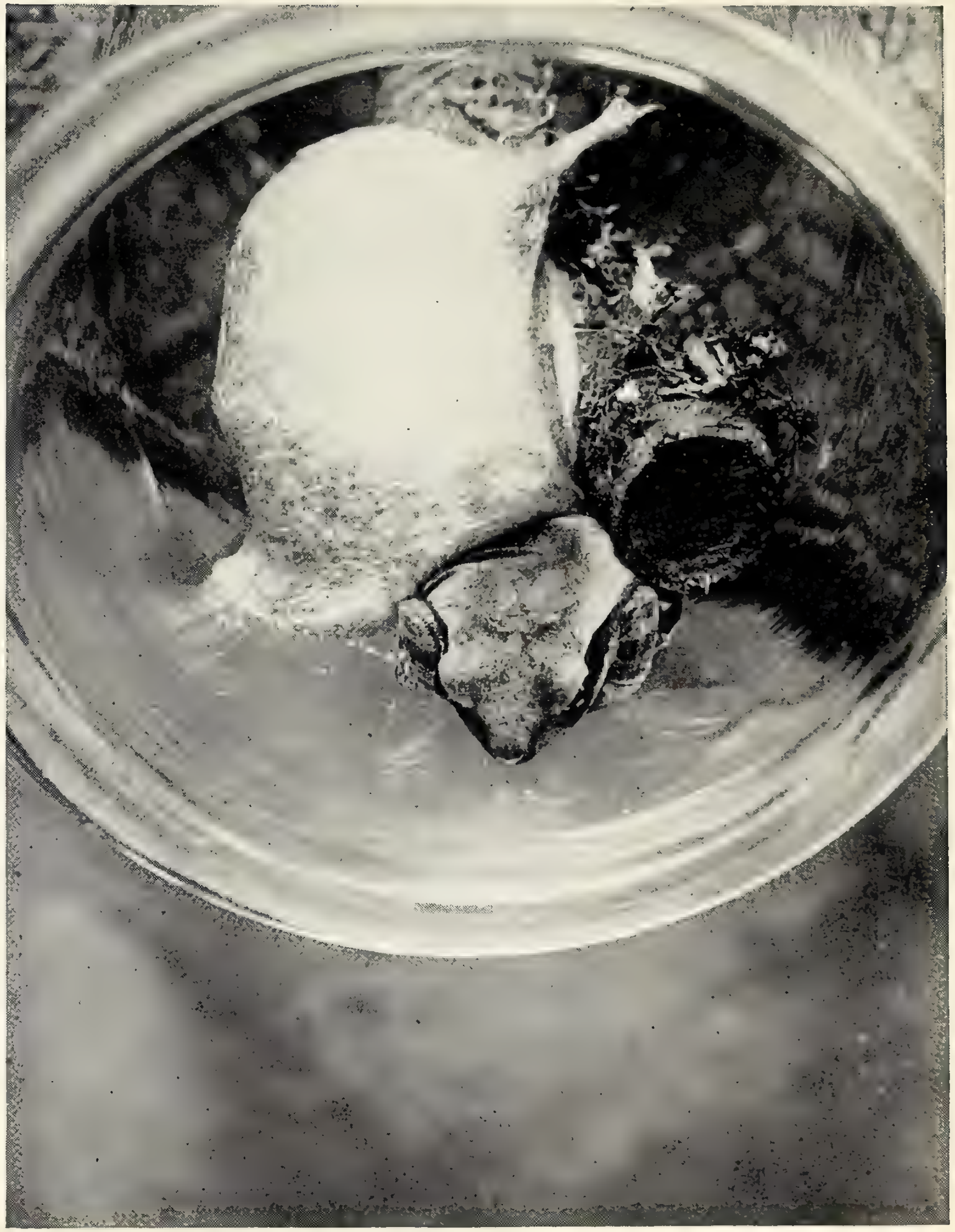
The spawn 'nests' appear like spent foam that is frequently deposited by the waves on a beach. They are yellowish in colour, measuring from 2 to 4 ins. in diameter. The shape is generally almost globular. The outer surface of the mass dries perfectly crisp, unless it is deposited in places where it is being continually moistened by water. The drying of the surface helps to conserve the moisture within the mass should it be exposed to sunshine. If deposited in places where it is being continually wetted, the whole 'nest' generally slips down and floats on the surface of the water. In the very moist interior of the mass of spawn the tadpoles pass their embryonic stages, until such time as they are able to swim about freely. When they are ready to leave the 'nest' a hole is formed at the bottom by the wriggling of the tadpoles and they drop into the water below. Should the nest be in water at the time of emergence, the tadpoles when hatched hang on to it as it floats about and feed on its substance. The spawn is never laid directly in water, though it may be deposited near the surface. Many 'nests' which I found in the cisterns at the Kanari Caves, were attacked by ants and cockroaches, the latter had even deposited their egg cases inside the 'nest'. Some of the 'nests' in the cisterns of the Kanari Caves were deposited under the stones. In these cases the 'nests' floated out when rain water filled the cisterns.

The tadpoles swim about very actively as soon as they leave the 'nest'. The development is comparatively rapid. Out of spawn taken on the 29th July (1928) development was completed by the 12th September. Other details of development I give below. After leaving the water the young frogs rest for a considerable time. The tail is gradually absorbed. The mouth keeps opening and closing as though the frog was suffocating or trying to get rid of something in its mouth. Once the young frog leaves the water, it endeavours to rid itself of its tail specially when it has withered to just a short stump by kicking and rubbing at it with its hind legs—a sort of massage. During this period they do not eat for about three or four days, but after this resting period feed voraciously. If newly developed young frogs fall back into the water and find themselves unable to get out, they drown within a space of twenty minutes to half an hour.

These frogs, whether young or old, when perched on a perpendicular surface always sit with their heads turned away from the direction of the ground pointing upwards. If the jar in which they



The Chunam Frog (*Rhacophorus maculatus*, Boulenger) showing the adhesive discs.



The Chunam Frog (*Rhacophorus maculatus*, Boulenger) a female with spawn 'nest.'

Photos by C. McCann.

were contained was reversed causing them to face downward, they would almost immediately all turn round and face upwards once more.

The leap of the young frogs is comparatively great. A tadpole with only the two hind legs fully developed was able to jump a maximum distance of 75 mm. Another with all the four legs developed and which had not yet left the water was able to cover a distance of 150 mm., while one which had left the water and in which the tail was not absorbed covered a maximum distance of 300 mm. Double each time!

The tadpole when about to leave the water changes colour and becomes a dirty yellowish in tone above.

NOTES ON THE DEVELOPMENT OF THE TADPOLES.

This spawn 'nest' was obtained in a cistern at the Kanari Caves, Salsette, on the 10th June 1929, under some stones.

11-6-29. Egg removed from the 'nest'. It was perfectly spherical, creamy, and measured 1.5 mm. There was no differentiation to be seen.

12-6-29. Larva taken from the 'nest' Plate IX, Fig. 1, measured 3 mm. The different parts of the body were quite distinct. The head region was subacute. Abdomen distinct with the anal pore. The larva was of a creamy colour like the egg.

16-6-29. This day the tadpoles emerged from the 'nest'. No external gills present. No 'suckers'. Horny teeth and beak quite horny. No palatine plate present. A distinct shining spot on the top of the snout. This spot is present throughout the tadpole stage and is only lost just before the frog is about to leave the water. Spiracle or branchial pore well developed and opening on the left side of the body. Anal pore opening on the right side of the caudal fin membrane, not at the lower margin. Lower lip frilled. Length of tadpole 12 mm.

18-6-29. Length of tadpole 16 mm. Pigment intensified. There appears two distinct types of pigment, (*a*) a pigment in the deeper layers which is seen through the transparent outer layer. These pigment bodies appear as central vaculoes, circular in outline through which the pigment flows in an irregular amoeboid shape. (Fig. 2, *a*.). (*b*) pigment in the upper transparent layer, which at first sight look like pigmented cilia, but soon they appear like the impurities so common in the well-known 'moss-agate' (Fig. 2, *b*). A third row of horny teeth was developed on the under lips. The hind limbs appeared as minute semispherical protuberances on either side of the tail. Anal pore lateral, the fin membrane is a little gathered at this point.

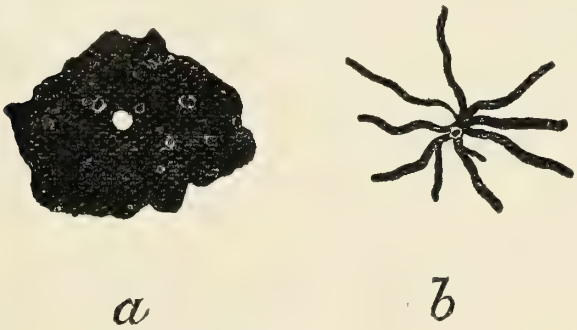


FIG. 2.

(a) Type of pigment in deeper layers.
(b) Type of pigment at surface.

22-6-29. Length of tadpole 19 mm. Topmost row of horny teeth in the upper jaw invaginated at the middle, 2nd row broken, a few teeth appear on either side of the upper portion of the beak representing a third row. Hind limbs very slightly enlarged. Both types of pigment increased.

26-6-29. Length of tadpole 25 mm. Pigment further increased. Hind limbs as conical protuberances. The upper portion of the hind limbs distinctly visible through the skin (femur etc.). The tail became slightly scimitar shaped and acuminate.

30-6-29. Length of tadpole 31 mm. Hind limbs become clavate protuberances. Surface pigment greatly increased. The tail became slightly more scimitar shaped.

5-7-29. Length of tadpole 35 mm. The toes of the hind limbs appear as clavate swellings on the original protuberances, seen on the 30th. June. Hind legs slightly pigmented. The pigment in the upper layer of the body almost completely obliterated the large blotches of the deeper layer, particularly in the region of the head and back. The lower lip became distinctly bilobed.

8-7-29. Hind limb 3 mm. long; toes slightly separated from one another, but appearing as oblong protuberances, of varying length. Pigmentation further increased. End of tail slightly bent downwards. Fore legs slightly discernable through the skin. As much developed as the hind legs.

11-7-29. Length of tadpole 41 mm. Hind legs 6.5 mm.; toes and web between the toes distinct. Discs distinct; but still in line with the outline of the toes. Toes slightly pigmented. Lower portion of the femur protruded. Fore legs with toes visible through the skin.

17-7-29. Length of tadpole 41 mm. Hind legs 17 mm. long; web and discs distinct. Pads on the underside of the feet visible. Fore legs with fully formed toes as in the hind legs. 'Thumb' of right fore leg protruding through a tear in the skin. The rows of horny teeth in the upper jaw completely lost, beak remained and the outermost row of teeth on the lower lip. The lower lip had shrunk. The tadpole now became 'hunch-backed'.

19-7-29. Length of tadpole 41 mm. Hind legs 19 mm. Fore legs protruded, fully formed. Lip almost completely reduced. All horny teeth and the lower portion of the beak lost.

23-7-29. Length of young frog which left water 18.5 mm., including the stump of a tail. Mouth undergoing transformation. At this period the young frogs left the water and adhered to the glass jar. After they leave the water they do not return unless alarmed, but will soon come out again. The tail is absorbed in about six to eight hours. During the transformation the young frog does not eat anything for about four to five days, after which it readily takes small flies.

Up to this time not all the tadpoles had completed their development, but by the 2nd. of August they were all almost near the completion of their metamorphosis.

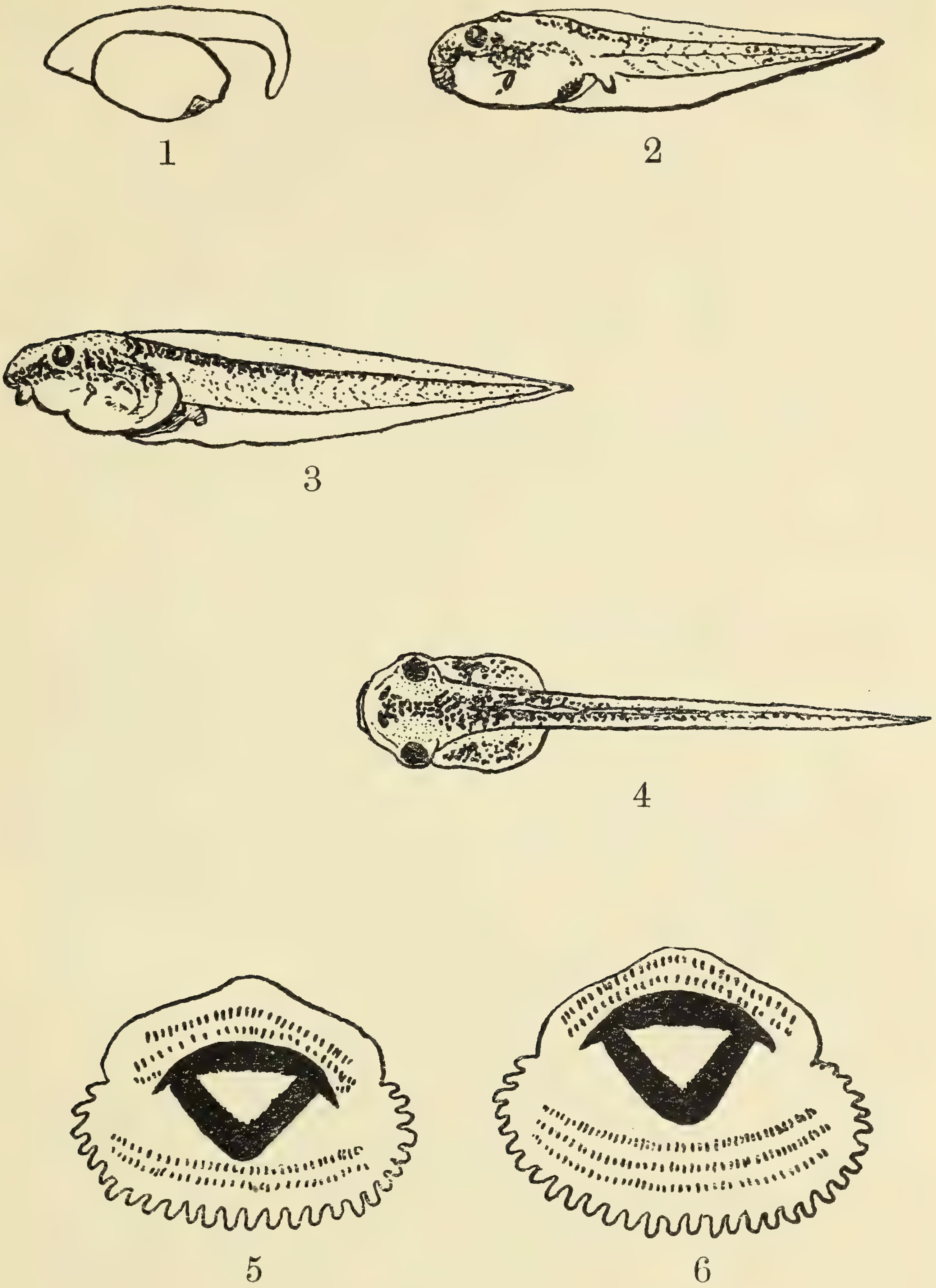
A fully formed young frog measured 15.5 mm.

In this species I have found the leech *Paraclepsis prædatrix*, Harding parasiting the adults.

MICROHYLA ORNATA, Boulenger.

The Black-throated Frog.

This species I found to be very common on the Tableland at Panchgani (4,400 ft.) living under stones. This frog appears to be nocturnal as I have never come across it moving about during the day, even on the dullest days during the monsoon. In the above mentioned locality I found its eggs and tadpoles in August, and in September, I again found sets of quite freshly laid eggs. The eggs



Del. C. McCann.

Rhacophorus maculatus, Boulenger. 1. Larva on 12-6-29, ×9. 2. Tadpole on 16-6-29, ×4. 3. Tadpole on 18-6-29, ×4. 4. Dorsal view of figure 3. 5. Mouth of a tadpole on 16-6-29 showing the arrangement of the horny teeth and beak. 6. As figure 5 but on the 18-6-29.

are laid singly, each egg being surrounded by a globular mucilaginous substance. The tadpoles develop within this protecting envelope and can easily be seen moving about in it. Finally they break through and move about freely. This usually takes place in from four to five days. Those that I kept under observation emerged, some on the fourth day and the balance on the fifth. The number of eggs laid is comparatively few—30 to 40.

The tadpoles of this species I have found somewhat difficult to rear and have consequently had little success with them. Fairly old tadpoles are not very difficult to keep, but to rear them from the egg is most trying. Apart from the difficulty of rearing the tadpoles, the small number of eggs laid by an individual makes it difficult to preserve specimens at the different stages of development.

Dr. Smith writing to me states: 'Very rare in Western India. We have none here from the Bombay area. Should be found in abundance throughout the rains, where it exists'.

PHILAUTUS BOMBAYENSIS.

The Bombay Philautus.

Though this frog is said to be somewhat rare, it is really a very common species in the hilly tracts of the Bombay Presidency appearing only during the monsoon. It is one of the most elusive frogs I know of, and is most difficult to locate, though one may be guided to the spot by its call. It is probably on account of this character that it is considered rare. It is extremely sharp sighted and trying to trace the frog by the sound is by no means simple. It will continue to call from its hiding place until one reaches a certain distance and then remains silent. By careful stalking at night with the aid of a torch, one is able to catch the performer. When once located the frog looks for all the world like a snail. This appearance is given to the male by the enormous vocal sacs which when inflated resembles the globular shell of a snail. Its most characteristic call is at once recognisable. The call may be likened to the rattle of castanettes kept up for three or four seconds followed by single claps and then the rattling is resumed. The voice is loud and can be heard for a considerable distance.

During the monsoon this frog may be heard both day and night. Being a tree frog it generally rests on the bark of trees and bushes (which it resembles) in an almost upside down position. In this position the large vocal sac is inflated to its maximum. When making the sound there is barely any deflation perceptible. When caught in this attitude it takes the animal some time before it is able to deflate the sac and when deflated the sac wrinkles up in so many folds under the 'chin'.

This species is an excellent weather prophet, for as soon as there is the slightest indication of rain it commences to call and no sooner the rain ceases for a few hours it is not to be heard any longer.

So far I have not been able to locate the spawn of this species.

Dr. Smith referring to this species in his letter writes: 'We have no examples here (British Museum) to compare with, but I have sent to Calcutta for some'.

RAMANELLA MONTANA.

In June 1928, I found a single specimen of this species in one of the cisterns at the Kanari Caves, Salsette Island. In the following year I discovered nine specimens of the same species in the same cistern. In both cases they were taken along with *Rana malabarica* and *Rhacophorus maculatus*. They were probably breeding in the cistern but I did not discover any spawn.

In general appearance it is a squat little creature, almost black in colour above, with no distinct markings. The underside is greyish, slightly, but finely mottled. The dorsal colouring harmonized well with the surrounding rocks on which they were seated. In every case I found them seated on the perpendicular faces of the cistern.

In habit they appeared to be somewhat sluggish and not at all timid. They sit with the body well pressed to the surface on which they are seated, with the limbs slightly drawn under the body.

The following is an extract from Dr. Smith's letter to me:—'*Ramanella montana.* 3 examples. I have kept two. The *Kaloula obscura* of Boulenger. Has not been recorded north of Malabar and does not agree entirely in colour pattern with Malabar specimens. Best got at the break of the rains.'

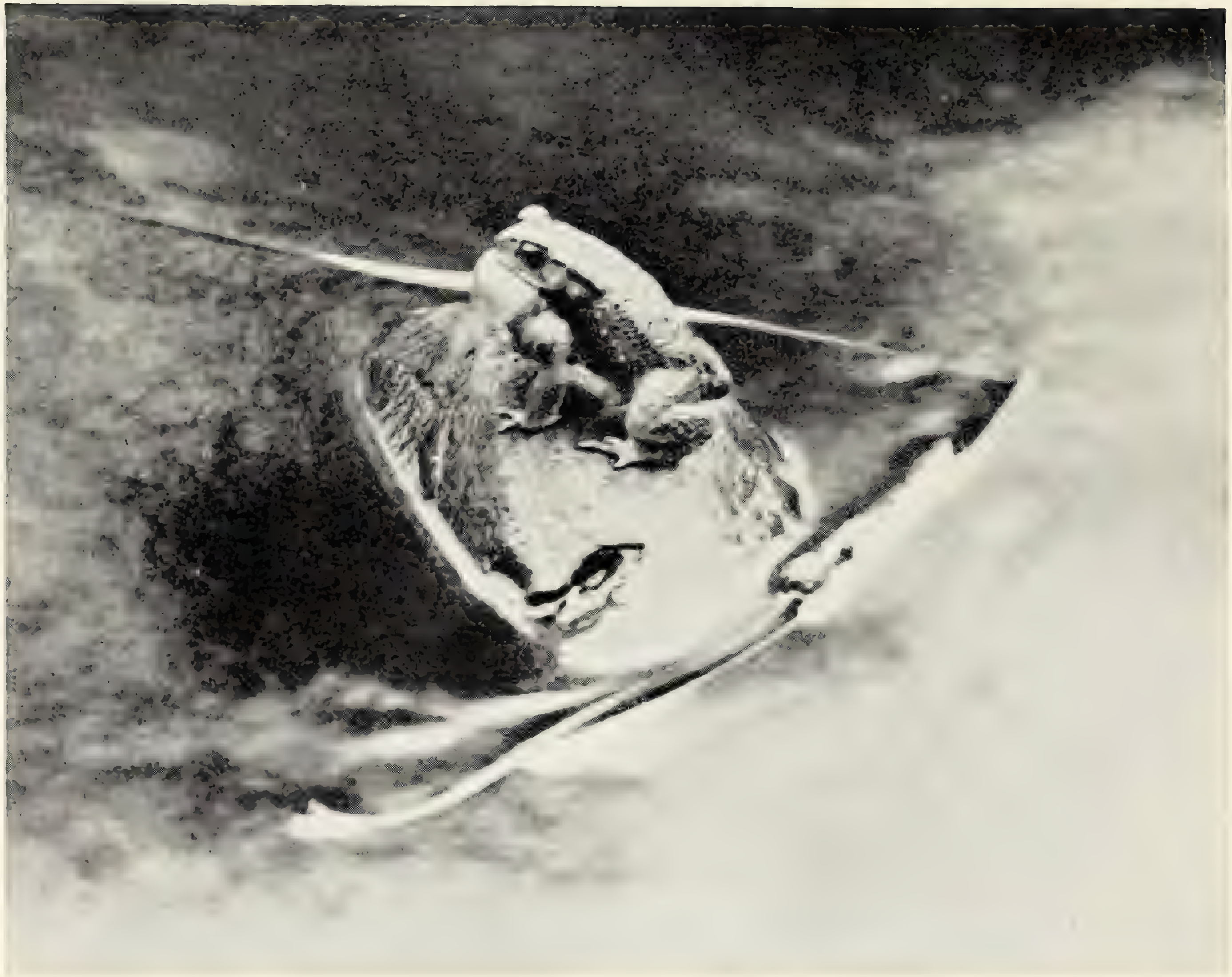
With regard to the colour of frogs, I have been at a total loss to give definite colouring in most cases, as I have found that frogs change colour very rapidly, and frequently, in life, so much so that a colour record at one time under certain conditions does not suit the same species in a changed environment. This remark is applicable to many species, in fact to most of the specimens that have come under my notice.

BUFO MELANOSTICTUS, Schneider.

The Common Indian Toad.

Though such a common creature, like the rest of the family little appears to be known about its habits. This toad is purely nocturnal, appearing soon after sunset. The day is spent in hiding in holes at the base of tree trunks and in walls, under stones or any other suitable places which will afford it a hide during the hours of daylight. Once a toad has found a suitable spot it will generally return to the same place with the break of day. If the hole be large enough to accommodate several, they will live together. They are also very fond of burying themselves in cotton or coir when available. In the districts toads frequently enter houses, and if not disturbed will take up their abode in some corner.

During the greater part of the year toads are silent in the drier parts of the country, but in places where there is an abundant rainfall and frequent showers they may be heard the whole year



The Common Indian Toad (*Bufo melanostictus*, Schneid.) showing the vocal sack inflated.

Photo by C. McCann.

round. During the period of silence they only utter a feeble plaintive note if handled. But after the break of the monsoon (in dry districts) this long silence is made up for. It is the general breeding season and all the males burst into 'song'—there is to be heard a continuous croaking everywhere. At this season the throat is tinged with brick-red or orange-yellow, which is only distinct when the gullar sac is inflated. The males are smaller than the females and are far in excess, competition for the possession of females is therefore very great and much struggling and fighting for possession is the result. These combats are much like what I have described in the case of the Bull-Frog.

I have observed these creatures in the streams of Salsette, vying with one another, so to speak, in their vocal efforts. Each sits on a small projecting stone croaking for all he is worth. Now and again one of them leaves his stone and goes across to that of another and tries to dislodge his rival, if successful the victor takes possession of the seat of the vanquished. If unsuccessful he retires to his own perch or finds another and recommences his croaking. This sort of thing goes on all the time. The stones are objects of continuous contest, they appear to form points of vantage from which the males are able to keep an eye on the surrounding 'country', in their ardent watch for a mate. The slightest movement on the part of one of the company in the water brings all the eager males to its side. Should the object of the pursuit be a male the competitors return to their respective perches, much disappointed, but should it be a female, the 'battle' begins, each 'doing' his utmost to take possession of her. Nothing disturbs the ardour of the contest. On several occasions I picked up a heap of toads, as many as eight, in one struggling mass, buried in the centre of which was the much sought after female.

In this situation amplexus is short and only lasts till the eggs have been deposited. But if the creatures are not in water amplexus frequently lasts for several days and even weeks. A couple I found in this condition, I kept in a box and in this state they remained for about twenty days. The explanation is I believe that when amplexus takes place on land that the pair keep together and hop about till they come to water.

The eggs are generally laid in running water, but they may also be laid in pools and tanks. The ova are discharged in long 'strings' composed of a gelatinous substance. These strings of eggs appear to me to be of particular advantage as they get entangled in the vegetation and are consequently not washed away by the currents, in which singly laid eggs would stand no chance. These strings may be yards in length. Two strings are produced at a time. As the larvæ appear, the gelatinous substance constituting the string swells and the larvæ remain within it for a time before they emerge. When the tadpoles emerge they adhere to the outside of the strings for some time before they become free-swimming, by means of the suckers. The time required for the development of the tadpoles from the eggs is approximately four days.

Though the general breeding season of this toad is at the beginning of the rains, I have no doubt that they breed the whole year round under favourable circumstances. This may of course vary with the locality. In the Naga Hills (Assam), I found these creatures breeding from January to March.

About a week after the rains have broken and mating has been accomplished, no more croaking is to be heard, in fact, few toads are to be seen by day, where a short while ago there were hundreds. The nuptial festivities are over and all are now back at the task of finding food. Though nocturnal in habit, at the breeding time these creatures are to be seen out both day and night.

Though I have never had the opportunity to keep the spawn of the toad under observation, it appears to me that the period of development is comparatively short, as I have found young toads which had undoubtedly just completed their metamorphosis in July. At the end of August, in some places, thousands (and I *mean* thousands) of young toads are to be seen all over the country. Once when on my way to Rajputana, I saw thousands of small toads at Kalol (B.B. & C.I.R.) in September. I say thousands but in reality there must have been millions. The track and the platform was full of tiny toads all hopping about. They were so numerous that at every step passengers trod on many at a time—it was unavoidable so much so that the place was full of crushed toads. All these tiny toads appeared to be moving in an easterly direction, but from where they came and whither they were going was a puzzle.

MAMMALS OF THE SUYDAM CUTTING SIKKIM EXPEDITION.[1]

BY

COLIN CAMPBELL SANBORN.

Locality.........Sikkim and Bengal Terai.
Date...........October 1930 to June 1931.
Collected by......H. Stevens and V. S. La Personne.

Through the generosity of Mr. C. Suydam Cutting of New York City, Field Museum of Natural History of Chicago has received a large collection of mammals, birds, and reptiles obtained by the well-known collector, Mr. Herbert Stevens, in Bengal Terai and Sikkim.

The mammal collection contains 412 specimens representing 57 species and 43 genera. This material is supplementary to the collections listed in the Bombay Natural History Society's reports No. 23 Sikkim, No. 26 Darjiling, No. 27 Bhotan Duars, and No. 28 Kalimpong. Collections were made at points not here-to-fore visited, and the following species of special interest were collected: *Anurosorex assamensis*, *Martes toufœus*, *Canis laniger*, *Belomys pearsoni* and *Lepus oiostolus*.

The work was begun on October 9, 1930 at Haldibari and terminated on June 25, 1931 at Lachung. During part of the time Mr. Stevens had the assistance of Mr. V. S. La Personne who carried on the work after Mr. Stevens was called away the last of April.

COLLECTING STATIONS.

Cooch Behar, Haldibari	... Oct. 9-19, 1930.
Bengal, Sivok	... Oct. 22-Nov. 17.
,, Mangpu	... Nov. 23-28.
,, Sangsir ,, Mangpu ,, Tarkhola	... Dec. 31, 1930-Jan. 21, 1931.
Sikkim, Lingtam	... Jan. 23-Feb. 28.
,, Rongli ,, Sedonchen ,, Gnatong ,, Jeluk	... March and April.
,, Dikchu	... May 2.
,, Toong	... May 4.
,, Chungtang	... May 5-9.
,, Lachen	... May 12-14.
,, Thangu	... May 17-28.
,, Gyagong ,, Lachung ,, Ghora-la	... June 4-25.

(1) **Macaca mulatta**, Zimm.

The Rhesus.

For synonomy see Hinton and Wroughton, *J. B. N. H. S.*, Vol. 27, p. 668.
♂ 1, Sivok; ♂ 1, ♀ im. 1, Mangpu.

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(2) **Macaca assamensis,** McCl.

The Himalayan Monkey.

For synonomy see Hinton and Wroughton, *J. B. N. H. S.*, Vol. 27, p. 669.
♀ 1, Sangsir; ♀ 1, Tarkhola; ♂ 1, ♀ 2, Lingtam.

(3) **Pithecus schistaceus,** Hodgs.

The Himalayan Langur.

(Synonymy in No. 15.)

♂ 1, ♀ 1, juv. 1, Lingtam; ♀ 1, ♀ juv. 1, Lachung; ♀ 1, Lachen.

(4) **Cynopterus sphinx sphinx,** Vahl.

The Southern Short-nosed Fruit Bat.

(Synonymy in No. 6.)

♀ 1, Sivok.

(5) **Lyroderma lyra lyra,** Geoff.

The Indian Vampire Bat.

(Synonymy in No. 1.)

♂ 1, ♀ 3, Sivok.

(6) **Barbastella darjelingensis,** Horsf.

The Eastern Barbastel.

(Synonymy in No. 26.)

♂ 1, in al., Mangpu.

(7) **Nyctalus labiatus,** Hodgs.

The Indian Noctule Bat.

(Synonymy in No. 25.)

♀ 2, Lingtam.

(8) **Pipistrellus coromandra,** Gray.

The Coromandel Pipistrel.

(Synonymy in No. 5.)

♂ 3, 2 in al., ♀ 6, 3 in al., Haldibari; ♂ 1, ♀ 2 in al., Mangpu.

(9) **Pipistrellus babu,** Thomas.

The Babu Pipistrel.

(Synonymy in No. 26.)

♀ 2, 1 in al., Rongli.

(10) **Myotis sicarius,** Thos.

The Sikkim Myotis.

(Synonymy in No. 26.)

♂ 1, in al. ♀ 2, Rongli.

(11) **Myotis caliginosus,** Tomes.

Tome's Whiskered Bat.

(Synonymy in No. 23.)

♂ 1, Lachung; in al. ♂ 1, Jeluk.

(12) **Murina tubinaris,** Scully.

Scully's Tube-nosed Bat.

(Synonymy in No. 25.)

♂ 1, Chungtang.

(13) **Tupaia belangeri lepcha,** Thos.

The Sikkim Tree Shrew.

For synonomy see Fry, *J. B. N. H. S.*, Vol. 29, p. 90.
♂ 5, ♀ 4, Mangpu; ♀ 1, Sangsir.

(14) **Talpa micrura,** Hodgs.

The Short-tailed Mole.

(Synonymy in No. 23.)

♂ 2, ♀ 2, Mangpu; ♂ 1, Jeluk; ♀ 1, Tarkhola.

(15) **Soriculus nigrescens,** Gray.

The Sikkim Brown-toothed Shrew.

(Synonymy in No. 15.)

♂ 1, Lingtam.

(16) **Soriculus caudatus,** Horsf.

Hodgson's Brown-toothed Shrew.

(Synonymy in No. 15.)

♂ 2, ♀ 1, Lingtam.

(17) **Suncus cæruleus giganteus,** Geoff.

The Giant Shrew.

For synonymy see Lindsay, *J. B. N. H. S.*, Vol. 33, p. 329.
♂ 3, ♀ 13, Haldibari.

(18) **Suncus soccatus,** Hodgs.

The Darjeeling Musk Shrew.

For synonymy see Lindsay, *J. B. N. H. S.*, Vol. 33, p. 332.
♂ 2, ♀ 1, Mangpu; ♀ 1, Sangsir; ♀ 3.
♀ 1, Lingtam; in al. 1, Rongli.

(19) **Crocidura** sp.

♂ 1, ♀ 1, Lingtam.

(20) **Anurosorex assamensis,** And.

The Assam Short-tailed Shrew.

1875. *Anurosorex assamensis*, Anderson, *A. M. N. H.*, (4), Vol. 16, p. 282.
♀ 1, Lingtam.

The great size of this specimen seems to leave no other course than to call it *assamensis*. It measures total length 114 mm.; tail 17; hind foot 15. Skull: superior margin of foramen magnum to tip of premaxillae 27.8 mm.; greatest length, including incisors 29.2; palatal length 13; mastoid width 15; upper tooth row 14.2.

(21) **Nectogale sikkimensis,** de Wint.

The Finger-tailed Water Shrew

(Synonymy in No. 23.)

♂ 1, ♀ 1, 1 (not sexed), Chungtang; ♂ 1, Lachen: ♂ 2, ♀ 1, Lachung.

(22) **Felis bengalensis,** Kerr.

The Leopard Cat.

(Synonymy in No. 11.)

♂ 1, ♀ 1, Lingtam.

(23) **Viverra zibetha zibetha,** L.

The Large Indian Civet

(Synonymy in No. 14.)

♂ 1, Sivok; ♂ 1, Rungpo; ♂ 1, ♂ im. 2, ♀ im., 1, Mangpu.

(24) **Prionodon pardicolor,** Hodgs.

The Indian Tiger Civet.

(Synonymy in No. 23.)

1 (not sexed), Lingtam; ♀ 1, Sedonchen; ♂ 1, Jeluk.

(25) **Herpestes mungo mungo,** Gmel.

The Common Bengal Mongoose.

(Synonymy in No. 1.)

♂ 1, ♀ 2, Haldibari.

(26) **Herpestes urva**, Hodgs.

The Crab-eating Mongoose.

(Synonymy in No. 23.)

♀ 1, Sivok.

(27) **Canis indicus indicus,** Hodgs.

The Common Indian Jackal.

(Synonymy in No. 1.)

♂ 1, Mangpu; ♂ 1, Sivok.

(28) **Canis laniger,** Hodgs.

The Himalayan Wolf.

1835. *Lupus laniger*, Hodgs., *Calc. Journ. N. H.*, Vol. 7, p. 474.

♂ 2, ♀ 1, Lachung.

(29) **Martes toufœus,** Hodgs.

The Tibetan Beech Marten.

Mustela? toufœus, Hodgson, *J. A. S. B.*, Vol. 11, p. 281.

♂ 1, Ghora-la, 17,000 ft.

(30) **Mustela subhemachalana,** Hodgs.

The Himalayan Weasel.

(Synonymy in No. 23.)

♂ 1, Lingtam.

(31) **Mustela kathiah,** Hodgs.

The Yellow-bellied Weasel.

(Synonymy in No. 15.)

♂ 1, Mangpu.

(32) **Lutra lutra nair,** F. Cuv.

The Common Otter.

(Synonymy in No. 37.)

1 (not sexed, no skull), "Sikkim".

(33) **Petaurista nobilis,** Gray.

The Himalayan Flying Squirrel.

(Synonymy in No. 23.)

♂ 1, 1 emb. in al., Jeluk.

(34) **Belomys pearsoni,** Gray.

The Hairy-footed Flying Squirrel.

1842. *Sciuropterus pearsonii*, Gray, *A. M. N. H.*, Vol. 10, p. 263.
♀ 1, Mangpu.

I find no record of the Mammal Survey's having taken this squirrel so it must be quite scare or very hard to catch.

(35) **Ratufa gigantea gigantea,** McCl.

The Assam Giant Squirrel.

(Synonymy in No. 14.)

♂ 3, 1 (not sexed), Sivok; ♂ 4, ♀ 1, Sangsir; ♂ 1, ♀ 1, Tarkhola.

(36) **Dremomys lokriah lokriah,** Hodgs.

The Long-snouted Nepal Squirrel.

(Synonymy in No. 23.)

♂ 6, ♀ 5, Jeluk; ♂ 1, Lachen.

(37) **Dremomys lokriah bhotia,** Wr.

The Long-snouted Bhootan Squirrel.

(Synonymy in No. 23.)

♂ 6, ♀ 2, Chungtang; ♂ 1, Lachung.

(38) **Callosciurus crumpi,** Wr.

Crump's Squirrel.

(Synonymy in No. 23.)

♂ 1, ♀ 3, Lingtam.

(39) **Tomeutes lokroides,** Hodgs.

The Hoary-bellied Himalayan Squirrel.

(Synonymy in No. 23.)

♀ 2, Sivok; ♂ 8, ♀ 9, Lingtam; ♂ 3, ♀ 1, Sangsir; ♂ 3, ♀ 4, 1 (not sexed), Mangpu; ♀ 1, Dikchu; ♀ 1, Toong.

(40) **Funambulus pennanti,** Wr.

The Common Five-striped Squirrel.

(Synonymy in No. 1.)

♂ 2, ♀ 6, Haldibari; ♀ 1, Sivok.

(41) **Tamiops macclellandi,** Horsf.

The Striped Himalayan Squirrel.

(Synonymy in No. 20.)

♂ 16, ♀ 17, Lingtam; ♀ 4, Chungtang.

(42) **Marmota himalayana** Hodgs.

The Tibet Marmot.

(Synonymy in No. 23.)

♂ 3, ♀ 1, Thangu; ♀ 2, Tibet-Sikkim border, above Thangu, 16,000 ft.; ♂ 1, Gyangong; ♀ 1, Ghora-la.

(43) **Gunomys bengalensis,** Gray and Hardw.

The Bengal Mole Rat.

(Synonymy in No. 19.)

♀ 1, Haldibari; ♀ 5, Mangpu.

(44) **Dacnomys millardi,** Thos.

The Large-toothed Giant Rat.

(Synonymy in No. 26.)

♀ 1, Mangpu.

(45) **Rattus nitidus,** Hodgs.

Hodgson's Gray-bellied Rat.

(Synonymy in No. 15.)

♂ 5, ♀ 2, Mangpu; ♂ 1, ♀ 4, Gnatong; ♂ 14, ♀ 19, Lingtam.

(46) **Rattus rattus sikkimensis,** Hinton.

The Sikkim Tree Rat.

1919. *Rattus rattus sikkimensis*, Hinton, *J. B. N. H. S.*, Vol. 26, p. 394.

♀ 2, Haldibari; ♂ 4, ♀ 3, 1 (not sexed), Mangpu; ♂ 5, ♀ 7, Lingtam; ♀ 1, Tarkhola.

(47) **Rattus fulvescens,** Gray.

The Chestnut Rat.

(Synonymy in No. 15.)

♀ 2, Mangpu; ♂ 4, ♀ 6, Lingtam; ♂ 1, Chungtang.

(48) **Rattus eha,** Wr.

The Spectacled Rat.

(Synonymy in No. 23.)

♂ 7, ♀ 3, Lachen.

In one specimen there is a small strip of pure white hairs in the centre of the chest.

(49) **Rattus flavipectus titsæ,** Hinton.

The Sikkim Rat.

1918. *Rattus rattus tistœ*, Hinton, *J. B. N. H. S.*, Vol. 26, p. 68.

♂ 1, ♀ 2, Haldibari; ♂ 1, ♀ 1, Sivok; ♂ 8, ♀ 12, Mangpu; ♀ 2, Sangsir; ♂ 1, Lingtam.

(50) **Mus homourus,** Hodgs.

The Himalayan House Mouse.

(Synonymy in No. 15.)

♀ 1, Chungtang.

(51) **Leggada pahari,** Thos.

The Sikkim Hill Mouse.

1916. *Mus pahari*, Thomas, *J. B. N. H. S.*, Vol. 24, p. 414.
1919. *Leggada pahari*, Thomas, *J. B. N. H. S.*, Vol. 26, p. 420.

♂ 1, ♀ 3, Lingtam.

(52) **Neodon sikkimensis,** Hodgson.

The Sikkim Vole.

1849. *Neodon sikkimensis*, *A. M. N. H.*, (2), Vol. 3, p. 203.

♂ 3, ♀ 1, Lachen; ♂ 11, ♀ 3, Thangu.

(53) **Acanthion hodgsoni,** Gray.

The Crestless Himalayan Porcupine.

(Synonymy in No. 27.)

♂ 1, ♀ 1, Mangpu.

(54) **Lepus ruficaudatus,** Geoff.

The Common Indian Hare.

(Synonymy in No. 15.)

♂ 1, Munsong.

(55) **Lepus oiostolus,** Hodgs.

The Woolly Hare.

(Synonymy in No. 37.)

♂ 1, Gyagong, 16,000 ft.

(56) **Ochotona sikimaria**, Thos.

The Sikkim Mouse Hare.

1922. *Ochotona sikimaria*, Thomas, *A. M. N. H.*, (9), Vol. 9, p. 187.

♂ 1, ♀ 1, Gnatong; ♀ 2, Lachen; ♂ 3, ♀ 4, Thangu.

(57) **Ovis hodgsoni**, Blyth.

The Great Tibetan Sheep.

1840. *Ovis hodgsoni*, Blyth, *Proc. Zool. Soc. Lond.*, p. 65.

♀ 1, juv. 2, Sikkim, border of Tibet.

These specimens were taken by Mr. C. Suydam Cutting.

THE HOT-WEATHER FERNS OF MAHABLESHWAR.

BY

R. B. EWBANK, C.I.E., I.C.S., F.L.S.

It has been my good fortune to spend two hot seasons (April and May) in Mahăbleshwar, and I have also visited the station for a few days at the end of October. During these visits I have roamed over every part of the plateau, and have prepared a hand-list of all the ferns which I have come across in the hot weather. I owe a special acknowledgment to Professor J. d'Almeida who has been kind enough to verify, and, where necessary, to correct, my identifications by reference to the herbarium at St. Xavier's College. I have constantly referred to Beddome's *Handbook to the Ferns of British India, Ceylon, and the Malay Peninsula* and to Blatter and d'Almeida's *Ferns of Bombay* and my debt to these invaluable works will be obvious to all who know them. These field notes are simply intended to supplement the careful descriptions of the various species which they give, from the point of view of a naturalist following in their steps.

The limits of the plateau are Arthur's Seat on the north, Kate's Point and Lingmala Waterfall on the east, Baghdad and Gaolani Points on the south, and Bombay and Lodwick Points on the west. The distance from north to south is about 9 miles and from east to west 5 miles. The plateau which is bounded by an almost continuous escarpment of rock varies in elevation from 4,000 to 4,700 feet. On the west it is covered with evergreen forest which rapidly thins towards the east as the rainfall decreases and the number of deciduous species of trees, usually associated with the monsoon forests of the Presidency, increases. The following description quoted from Talbot succinctly explains the conditions which make the existence of so many varieties of ferns possible in so small an area:—

'The Mahableshwar plateau (4,500 ft.) capped with laterite and with a heavy annual monsoon rainfall of 350 in., also the highest area of considerable extent in the Presidency, is covered with dwarf forests of montane type, but containing species characteristic of low elevations such as *Eugenia Jambolana* and others. That the constituent species in these forests are the same as those found at lower elevations or in the plains is remarkable, as the Nilgiri montane woodland flora further south appears abruptly in the Bababuden Hills of Mysore at an elevation scarcely exceeding that at Mahableshwar.

'Woodland over considerable areas along the Western Ghats, owing to the pronounced influence of the soil, assumes a transitional form between rain and monsoon forest in which the constituent species belong to one or other of these formations in varying proportions. Examples are found in Kanara on the spurs of the Ghats near the sea coast whether on granitic, lateritic or schistose soils. The forests at Matheran and on the higher Nasik and Satara Ghats are further examples.

'The stunted elfin-wood on the Mahableshwar laterite can only be considered as an extreme kind of this formation'.

Talbot is not in fact correct in his statement about the average rainfall. I am indebted to Dr. C. W. Normand, Director General of the Meteorological Department, for the following authoritative note on the climate of Mahableshwar:—

'The rainy season begins early in June. For almost three months the sun is hidden by the thick mist and cloud that envelop the station; and rain, though not continuous, falls most of the time. Only about one per cent of the days during this period are rainless, and at intervals of vigorous monsoon the rainfall may exceed five inches a day for three or four days in succession. The month of maximum rainfall intensity is July, when the daily *average* of rainfall is as much as 3½ inches. A very strong westerly or south-westerly wind blows continually from the sea. This constant wind and the protective thick cloak of cloud produce a remarkably steady temperature both from day to day and from day to night. The average temperature is about 64° and the difference between day and night is less than 4°.

'The monsoon tails off in September. In October, when the drenching southwest winds have ceased, but the hills are kept fresh by occasional thunderstorms and misty evenings, Mahableshwar is at its best. The mean temperature is then about 67°. In the succeeding months the climate becomes dry, winds from easterly directions predominate, and the sunshine and glare by day are intense. The daily range of temperature increases to about 20° and nights become cool enough to make fires a comfort. From November to January the mean temperature is about 64°. From February temperature rises and the hottest month is April, when on hot afternoons the air temperature rises to 90° or more. The hot days of March and April are however tempered by a cool, moist sea-wind which sweeps over the station in the evenings. As April advances, the sea wind becomes more continuous and from the end of April northwesterly to westerly winds predominate and gradually strengthen and import increasing quantities of cool moist air. Occasional thunderstorms occur, and towards the end of May morning and evening mists become frequent.'

Month	Mean Temperature	Rainfall	
		Mean Monthly Total	Rainy Days
January ...	64	0·1	0·2
February ...	68	0·1	0·1
March ...	72	0·1	0·3
April ...	76	1·3	1·6
May ...	73	1·9	3
June ...	66	46·2	23
July ...	64	104·8	30
August ...	64	74·9	30
September ...	64	28·4	23
October ...	66	6·0	8
November ...	65	1·5	2·4
December ...	64	0·3	0·6
Year ...	67	265·6	122

The marginal statement gives Dr. Normand's figures regarding average temperature and rainfall. By 'rainy days' is meant the average number of days per month on which the rainfall was at least 0·1 inch. From the botanical point of view, it is important to note that cool and moist sea winds arrive about the end of April, and that morning and evening mists soon precipitate themselves on the leaves of the evergreen trees and drip on the plants below.

The hot weather is of course the worst possible season for studying ferns; but it is of some interest to note what ferns are able to survive till the advent of monsoon. It is also the season when most visitors come to Mahableshwar and may wish to learn something of the ferns which they then find on the plateau. I have therefore confined my list to those ferns only which may be found in the months of April and May.

I have not included in my list ferns that may be seen on the roadside on the way up the Ghats, e.g., *Actiniopteris dichotoma* (Bedd.), *Adiantum Caudatum* (L.) and *Lastrea crenata* (Bedd.) or ferns peculiar to Panchgani, e.g., *Nephrolepis paucifrondosa* (d'Almeida), since they do not appear to occur within the limits to which this list is confined. Nor have I included species which occur at Mahableshwar only in cultivation, e.g., Nephrolepis Cordifolia.

1. *Pteris aquilina* (*L.*) Bracker.

This worldwide fern grows abundantly on the plateau, preferring light shade and open grassy glades. I have found specimens 8 feet high but 2 to 3 feet is the ordinary size. In the hot weather the previous year's fronds are withering, the decay usually starting with the lowest pinnae. The fern differs in only two respects from specimens which I have gathered in other parts of the world. The young fronds, as they begin to unroll, have not the rusty-brown knotted look which in England makes them resemble an eagle's claw and is possibly the origin of the name of the species. In Mahableshwar they are usually pale green, loosely rolled, and stalky. The other point is that young fronds, appearing towards the end of the hot weather, are in open places sometimes so fertile that the backs of the pinnules, which are distinctly contracted, can hardly be seen owing to the continuous heavy lines of fructification breaking out from below the marginal involucres. The texture of these fronds is thick and heavy; and with their finer cutting and reddish brown backs they almost appear to be a distinct variety.

2. *Pteris quadriaurita* (Retz.).

This fern can readily be recognised by the two pinnae that descend from the lower side of the lowest or two lowest pairs of pinnae and by the long terminal pinna in which the frond culminates. Hope in this Journal (Vol. XIII, page 452, January 20th. 1901) speaks of this as a Protean species. But I find little variation in the Mahableshwar specimens. As the fern withers the pinnae decay irregularly in small orange patches. The costae are usually furnished with bristles (setae) scarcely visible to the naked eye. The variety '*setigera*' (Bedd.), which is distinguished by narrower segments than in the type, and by stiff hairs on the rachis and costa, is not uncommon.

3. *Pteris biaurita* (L.).

The leading authorities (Hooker, Baker, Clarke and Beddome) classify this fern as a distinct species on the ground of difference in venation. In the preceding species the veinlets are once-forked and free, while in this species the inferior veinlets unite in pairs to form an arch below the sinus. Hope in this Journal (Vol. XIII, page 456) expresses the opinion that the two species are abundantly unlike, but does not give details. Blatter and d'Almeida take the opposite view and regard both this and the following species as mere forms of *quadriaurita*. Specimens of *biaurita* will be found on the bank of the stream above the Chinaman's Waterfall. Their segments are broader, blunter and closer to each other and are not cut down so far towards the costa as in *quadriaurita*. The pinnae are rarely quite flat, until the frond is mature, but form a sort of V-shaped channel with the costa at the base. I have however found samples of *quadriaurita* in damp and shady places which exhibit most or all of these characteristics. Apart from venation, I have noticed that this species has no bristles on the costa.

4. *Pteris nemoralis* (Willd).

In habit of growth this species exactly resembles biaurita, the only difference being that both the preceding varieties of venation occur in it. The inferior veins of the segments sometimes form an arch and sometimes miss connection. Specimens can be found near the stream at Lingmala.

5. *Nephrodium molle* (Desv.).

This fern is found in damp and shady places, and attracts attention by the vivid green of its young fronds which begin to appear in April and are much in evidence by the end of May. It is called 'tender' because it wilts soon after picking. The lower pinnae are gradually more distant and often become mere auricles. It is easily recognised as it is the only nephrodium on the plateau.

6. *Lastrea calcarata* (Hook.)—at about 4,200 feet.

7. *Lastrea Filix-mas* (Presl.) (Male Fern.)—common.

8. *Lastrea Filix-mas, Var, cochleata* (Bedd).

This is an interesting variety, common near Kate's Point. The pinnules of the fertile fronds are much contracted and covered on the back with very prominent involucres.

9. *Leucostegia immersa* (Presl.).

Rare. I have come across one specimen only in a damp place on the extreme western edge of the plateau.

10. *Gymnopteris variabilis* (Hook).

This fern likes flowing water and will be found in clumps above the Dhobi's Waterfall, near Lingmala, and in stream beds below

Tiger Path. The sterile fronds are entire. The veins and veinlets are very irregular, but they are distinct nearly to the margin. The texture is thick and the colour dark-green. The fertile fronds are narrow, densely covered with russet sori and much longer than the sterile fronds. Not infrequently the lower half of a frond is broad and sterile, while the upper half is suddenly contracted and fertile. I venture to doubt if Blatter and d'Almeida are right in assigning the Mahableshwar specimens to the variety '*lanceolata*' (Bedd.) of which the main veins are indistinct. I have always found the fern growing on the ground in stream beds and not on trees as stated by them. Possibly the variety to which they refer only makes its appearance during the monsoon.

11. *Pleopeltis linearis* (Thunb.).

This is an epiphyte on trees. In the hot weather it shrivels into olive-green, leathery, corkscrew-like fronds of about the thickness of boot-laces. But if placed in water or subjected to heavy rain, it recovers in a few hours and expands to its original size. The frond, which is thick and entire, curls tightly outwards and backwards from the margins in the hot weather in order to protect the sori, which, on its revival appear to be undamaged. Heavy rain fell on April 22 and 23, 1929, and at once the fronds, which in their withered state are liable to escape notice, unrolled themselves and became conspicuous on every mossy tree. By April 27th. they had all withered again and returned to their previous condition.

12. *Pleopeltis membranacea* (Don.).

This fern, prefers moist rocks or trees in deep shade, it dies down soon after the rains, the decay usually starting at the outside edge. Fresh fronds will be found growing freely at the beginning of May in places where conditions are favourable, e.g., on the walls of some cisterns to the south of the bazar. Elsewhere only the skeletons of withered fronds occasionally survive.

13. *Adiantum capillus veneris* (L.). Maiden Hair.

Small specimens may be found here and there on the walls of wells or cisterns, for instance beside the stream above the Fountain Hotel.

14. *Adiantum lunulatum* (Burm.).

The first delicate fronds, tinged with coppery brown, begin to appear in deep shade, on the western border of the plateau, before the end of May. They die down shortly after the rains. The fern grows abundantly on the Western Ghats but at this elevation does not attain a size comparable to the specimens found at lower levels. Blatter and d'Almeida appear to be mistaken in thinking that the fern does not occur above about 3,000 feet. I have found it at about 4,100 feet.

15. *Aspidium cicutarium* (Sw.).

The fronds are triangular in outline but very variable in size and cutting. The young fronds begin to appear in damp cool places about the middle of May. They are pale green and downy, and as a rule face skywards like bracken. But single fronds surviving from the previous year, and in course of withering, are not uncommon in places (for instance on the golf course near the 17th. brown). The sori are usually arranged in a line along the margins or on the tips of the pinnae. In the absence of sori the fronds can easily be identified by their shape and by their distinct venation, which is copiously netted.

16. *Osmunda regalis* (L.). Royal Fern.

Fine bushes of this fern grow in the stream bed above Lingmala. The fronds attain about 3 feet which is of course below the size attained in Europe. The specimens which I have met with have been fertile above and barren below. By the hot weather the fertile pinnules are shrivelled and drooping. The rest of the fronds are healthy enough, though a few reddish patches show that decay is at hand.

17. *Anisogonium esculentum* (Presl.).

Common on the banks of the stream from the lake to Lingmala. The frond is sometimes simply pinnate, but more usually pinnate above and bipinnate below. Fertile fronds are not uncommon in October, but I have never found a fertile frond in the hot weather.

18. *Asplenium laciniatum* (Don.).

In the hot weather this fern will be found shrivelled and pendent on trees, looking like dry sea-weed, with the edges of the pinnae curled loosely backwards, to protect the sori. In this condition the plant, desiccated and olive-green, looks at first sight like a wisp of lichen. After heavy rain it expands again, the pinnae reviving in sequence from the bottom upwards. As they unroll themselves, the sori will be found exactly as they were when the plant dried up, some with involucres unopened, some with the sporangia just showing and some fully open. The characteristic way in which this plant weathers the dry season by rolling up its fronds is not mentioned by any authorities on Indian ferns, except Blatter and d'Almeida, and is possibly therefore peculiar to Western India.

19. *Asplenium lunulatum* (Sw.).

This evergreen fern grows in colonies in damp places in the shade of rocks. It occurs for instance in a small cave on the edge of the lake. The old fronds are thick and fleshy with a shining surface. The light yellowish green of the young fronds as they make their appearance in the hot weather is very noticeable against the dark green of the old ones. In general appearance it very closely resembles the *Asplenium marinum* which is not uncommon on the west coast of the United Kingdom. Blatter and d'Almeida hold that the Mahableshwar fern is the variety *trapeziforme*, on the ground that the lowest pinnae are the largest. But at the three stations at which I have found the fern on the plateau, the lowest pinnae are not normally longer than those above them.

Beddome who is the first describer of this variety does not in his very sketchy description indicate clearly any other point in which the variety differs from the species.

20. *Athyrium falcatum* (Bedd.).

The fern at Mahableshwar corresponds exactly to Beddome's description, but the large obtuse auricle at both the superior and inferior base of the pinna, to which he draws attention, is usually found on the superior base only. This is a common fern but dies down soon after the rains, and in the hot weather only a few brownish and decaying specimens can be found in moist cool places.

21. *Athyrium Filix-fœmina* (Roth). Lady Fern.

Very common after the rains on banks. In open places fronds are often curved in a sickle shape and not more than 9 inches long, but amongst other herbage they usually grow straight and longer. The pinnules are sharply serrated; but there is considerable variation in the distance of the pinnules from each other and in the fineness of the cutting. Specimens are not found in the hot weather until the new fronds appear towards the end of May.

22. *Athyrium Hohenackerianum* (Bedd.).

Common in rains, but soon dies down. Young fronds appear towards the end of May. Apart from the bullate indusium which is not always easy to recognise, the pinnules are slightly broader and more close-set than in *Filix-fœmina* and the serratures are sharper and deeper.

23. *Cheilanthes farinosa* (Kaulf). Silver Fern.

This fern is common on walls and banks in exposed situations. During the hot weather the small coriaceous fronds curl up, each pinnule turning inwards and exposing its silvery back. After rain they expand quickly and exhibit their dark green upper surfaces. Young fronds appear in the shade in May and their backs are densely covered with white farina, which extends also to the rachis and costae. They are much larger than the persistent fronds which survive the hot weather, and are coarser in cutting. A few dealbate specimens of this type which wither in the autumn continue till the summer but do not revive after rain. There seem to be two distinct types of frond, one quite lanceolate and the other triangular, but they run into each other by innumerable gradations. Both the deltoid and the lanceolate types have scales that are sometimes chestnut, but more usually dark-centred and pale margined. I find great difficulty in distinguishing the specimens of '*farinosa*' from '*albo-marginata*' amongst the material which I have collected at Mahableshwar. C. B. Clarke, the author of the species *Cheilanthes albo-marginata* (Transactions of Linnaean Society, vol. 1 part vii, February (1880), lays stress on the lanceolate fronds, the stipe shorter than the frond, the yellow powder generally found on the lower surface and the pale-margined scales. Blatter and d'Almeida who identify this species at Mahableshwar, but do not closely follow Clarke, state the features which distinguish *albo-marginata* from *farinosa* as (1) the pale margined scales on the stipes as well as on the primary and secondary rachises and costae, (2) the lacerate indusia, (3) dwarfish sturdier habit, and comparatively small size of frond; (4) outline nearer to lanceolate than triangular. I venture to doubt if these characteristics are constant either on the triangular or lanceolate type of frond. Several of the specimens in my possession approach more closely to *Cheilanthes farinosa*, var *anceps*, as described by Blanford in the Journal of the Asiatic Society of Bengal, vol. lvii, part ii, No. 4, 1888, and accepted by Hope on page 249 of vol. xiii of the Journal of this Society, dated July 1900: but the lowest pairs of pinnae are not always sub-equal. The subdivision of the types of *Cheilanthes* as they appear at Mahableshwar into true species has not yet in my opinion been convincingly achieved and might afford a nice problem for a botanical visitor who has time to collect and examine a large number of graded specimens.

I subjoin a complete list of the species specifically ascribed to Mahableshwar by Blatter and d'Almeida, for convenience of reference. Some of them should be visible in the hot weather, e.g. *Blechnum* and *Drynaria*, but I have myself only come across those enumerated by me. The only species which I have added to the list is *Athyrium Hohenackerianum*.

1. Peranema cyatheoides
2. Leucostegia immersa
3. Leucostegia pulchra
4. Schizoloma ensifolia
5. Adiantum lunulatum
6. Adiantum capillus veneris
7. Cheilanthes farinosa
8. Cheilanthes albomarginata
9. Cheilanthes tenuifolia
10. Pteris pellucida
11. Pteris quadriaurita (and 3 varieties.)
12. Pteris aquilina
13. Blechum orientale
14. Asplenium lunulatum
15. Asplenium falcatum
16. Asplenium laciniatum
17. Athyrium falcatum
18. Athyrium Filix-fœmina (2 varieties.)
19. Athyrium gymnogrammoides
20. Anisogonium esculentum
21. Aspidium polymorphum
22. Aspidium cicutarium
23. Lastrea odontoloma
24. Lastrea Filix-mas (2 varieties.)
25. Lastrea sparsa
26. Nephrodium molle
27. Nephrolepis cordifolia
28. Drynaria quercifolia
29. Pleopeltis linearis
30. Pleopeltis membranacea
31. Gymnogramme leptophylla
32. Gymnopteris variabilis
33. Gymnopteris subcrenata
34. Osmunda regalis
35. Lygodium flexuosum.

THE BUTTERFLIES OF BALUCHISTAN.

By Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., F.R.G.S., F.Z.S., F.E.S.

Many years ago I asked to be posted to Baluchistan as I wished to get back to the frontier and I was certain that the butterflies of the borderland, between the Palæarctic and Oriental regions, would prove interesting. I succeeded in reaching the promised land in November 1911, just when insect life had become dormant for the winter, and was transferred to Simla in March 1912 before it had again awoken. However, fortune came my way in the end and I managed to spend the last four years of my service in Baluchistan in a position which enabled me to tour frequently over the whole province.

The only previous butterfly record for Baluchistan is a list of the butterflies of 'S. Afghanistan' (Sibi-Kandahar) published by the late Col. C. Swinhoe in T. E. S. 1895. About the same time the late Capt. E. Y. Watson collected in the area and some of his results are recorded in DeNiceville's *Butterflies of India*. Odd species have been obtained from time to time, and I recorded all that I could find in the first edition of my '*Identification of Indian Butterflies*'.

Baluchistan generally consists of tablelands and dry river beds at an elevation of 3,000 to 6,000 feet, interspersed with barren mountains rising sometimes to 11,000 feet. The Quetta district is situated in the basin of the Peshin Lora draining to the West through a corner of Afghanistan into the Nushki deserts, which extend Westwards to the Persian border and southwards through Kalat and Mekran to the sea West of Karachi. To the North is the Kwaja Amran range (Khojak Pass) extending Eastwards to the Toba plateau and separating Baluchistan from Afghanistan (Helmand basin) continuing as the inner frontier range to the Hindu Khush. Some 60 miles to the N.-E. of Quetta there rises the Zhob river, the cradle of the Afghan and Pathan races: North of Fort Sandeman the river meets the Gomal and then pierces the Suleiman range, draining across the Derajat plain to the Indus. South of the Zhob lies the Loralai area in the basin of the Nari which drains through the Sibi area into the Indus in Sind and is separated from India by the Suleiman range.

Baluchistan is a barren country with a rainfall of only 8 inches, of which three-fourths occur in the winter. There is no doubt that in the past there was a great deal more rain and that gradually the country is getting drier, comparatively fertile islands being left behind in a desert sea. The winter is severe, but is followed by a glorious spring, when insect and plant life are at their best: then follows a hot dry summer, which desiccates everything. There is no monsoon to revive life and consequently second broods of insects are the exception rather than the rule as elsewhere in India.

The butterflies, though requiring a great deal of looking for, are of great interest as might be expected in a country where West meets East. The insects of Baluchistan proper appertain primarily to the Persian division of the Palæarctic zone, but there is a well-defined infiltration from the Himalayas and Chitral through the Zhob and Afghanistan. The Sibi area, which forms part of political Baluchistan, appertains to the plains of Western India, and here occurs the Western limit of the Oriental zone, the Bolan and Suleiman range constituting a primary faunal border, the species on either side being very distinct.

The flat tablelands contain very few butterflies: it is on the hillsides clothed with aromatic scrub and along the few mountain streams where the interesting species must be looked for. I have found the following localities to have been the most productive, but I have no doubt that there are many others:

(*a*) Urak valley running East of Quetta to the intake of the water-supply, 5,500 to 6.500 feet. A valley with plenty of water and trees: it is Quetta's only beauty spot and Sunday picnic ground.

(*b*) Upper Urak is the continuation of the valley above the water-supply intake. It is a steep mountain stream and the collecting ground ranges from 6,500 to 8,000 feet.

(*c*) The slopes of Chiltan in the Spring 7,000 feet (Chiltan forest). There is a track to the right from mile 12 on the Kalat road along which cars can go for two or three miles and then there is a walk of about the same distance. In the spring the ground is carpeted with red tulips between bushes of wild cherry and almond.

(*d*) The Gwal forest (6,500 feet) into which there is a motorable track from about mile 35 on the left of the Zhob road. The country is dry but in the Spring when the wild almond is out there are good butterflies to be got.

(*e*) The Murgha Mehtarzai Pass 7,500 feet, at mile 50-51, on the Zhob road. The hillsides and small valleys on the South of the road are full of interest.

(*f*) The Khojak Pass starting with the lower slopes below Shelabagh 6,000 to 7,000 feet. The one or two valleys with water may also contain good butterflies.

(*g*) The Bogra Pass 7,500 feet on the wild lavender (so-called) and the mint on the Chaman side and the grassy slopes below the crest on the Toba side.

(*h*) The Ziarat road from mile 12, Juniper Kotal (6,800 feet); between the Wam Pass and Kahan (7,000 to 6,000 feet); Ziarat itself (8,000 feet), particularly the catchment area and the sides of the road about mile 100 near Raighora (5,000 feet).

(*i*) Shingarh, the hill station of Fort Sandeman, 8,600 feet, where the Chilgoza pine flourishes. Several species are only found here.

(*j*) The Torgarh (7,000 feet) S. W. of Fort Sandeman was visited by Col. C. H. Stockley in the Spring, and several interesting species were found.

The Toba plateau, Takhti Suleiman range and the Musa Khel hills would certainly repay exploitation, also the valleys N.-W. of Hindubagh.

Col. Swinhoe recorded 43 butterflies, making three species out of the Clouded Yellow (*Colias erate*) and two out of the common meadow blue (*Polyommatus icarus*). In my *Identification of Indian Butterflies* I gave 80 as the number from Baluchistan and Sind. As a result of four years collecting I have been able to increase the number to be found in Baluchistan to 108.

The following are new species or races from Baluchistan, all of which have been included in the second edition of my *Identification of Indian Butterflies*:

Euchloe charlonia pila and *doveri*: *Eumenis mniszechii balucha* and *pallida*: *Aulocera padma burnettii*: *Polyommatus sieversi felicia*: *Polyommatus hyrcana kwaja*: *Polyommatus iris hanna*: *Polyommatus bogra*: *Polyommatus eros shingara*: *Neolycaena connae*: *Carcharodus dravira balucha*.

All the types will be placed in the British Museum.

The following are new records for Baluchistan (* indicates new to India).

Tros aristolochiae: *Papilio demoleus*: *Pieris canidia*: *Catopsilia pomona* and *pyranthe*: *Gonepteryx rhamni; Ixias pyrene*: *Colotis amata* and *danae*: *Danais limniace* and *genutia*: *Pararge schakra*: *Aulocera padma*: *Ypthima asterope*: *Hypolimnas misippus* and *bolina*: *Precis hierta*: *Vanessa*, **atalanta* and *xanthomelas*: *Argynnis hyperbius*: *Atella phalanta*: *Tarucus theophrastus nigra* and **mediteraneæ*: *Azanus ubaldus*: *Polyommatus *sieversi, hyrcana, iris, *cyllarus *actis*: *Euchrysops pandava minuta*: **Tomares callimachus*: *Hasora alexis*: *Syrichtus orbifer*: *Erynnis marloyi*: *Eogenes alcides*.

In addition the following ex-Indian races have not been recorded from India before:—

Papilio machaon centralis: *Euchloe ausonia pulverata*: *Gonepteryx rhamni rhamni*: *Argynnis lathonia lathonia*: *Lycaena thetis lampon*: *Syrichtus orbifer carnea*.

Neither I nor the various people who have assisted me have succeeded in obtaining the following species recorded from Baluchistan:—

Hypermnestra helios: *Terias hecabe*: *Maniola wagneri*: *Chilades laius*: *Baoris mathias*: *Syrichtus evanidus*.

My butterfly collecting days in India are over, but it is a matter of great satisfaction to myself that I was able to close my career of 33 years in such a fascinating and interesting country as Baluchistan.

Capt. A. F. Hemming very kindly read through the proofs and pointed out certain mistakes in nomenclature which have been corrected.

LIST OF THE BUTTERFLIES OF BALUCHISTAN.

PAPILIONIDÆ. The Swallowtails.

1. **Tros aristolochiae,** F. The Common Rose. A black swallowtail with large white and red markings on the hindwings and the body red below. Common in India and the East. One specimen was obtained in September by Capt. R. R. Burnett at Fort Sandeman.

2. **Papilio demoleus demolus,** L. The Lime Butterfly. A tail-less yellow and black butterfly. Common enough in India and the East. Occurs rarely at Sibi and Mach in the Bolan.

3. **Papilio alexanor,** Esp. The Baluchi Swallowtail. A tailed yellow and black swallowtail, distinguished by the yellow tips to the antennæ. It occurs, never commonly, from S. Europe to Baluchistan, where it is very rare. I caught a female on Juniper Kotal on the 14th April and saw a specimen at Upper Urak in June. I recorded it in my *Identification* on the strength of a specimen presented by Mr. O. C. Ollenbach to the British Museum (See *J.B.N.H.S.* xxii, 281).

4. **Papilio machaon centralis,** Stg. The Common Yellow Swallowtail: yellow and black with a tail. Occurs from England throughout Europe, W. and N. Asia and the Himalayas to N. Burma. The Baluchistan race resemble the Persian race rather than the Himalayan, in that the yellow areas are paler and more extensive and the blue powdering on the hindwing more diffuse. Individuals are to be seen frequently from May to September at Upper Urak, Ziarat, Shingarh and Torghar (April).

5. **Hypermnestra helios balucha,** M. The Desert Apollo. A white butterfly with black markings and a double red spot in the middle of the forewing. The species occurs in Persia and Turkestan as well. The type of *balucha* is in the British Museum and there is a co-type in my collection, marked 'Nushki, April 1905,' both received from Mr. O. C. Ollenbach. There is a specimen labelled 'Kach' in the Indian Museum. I have searched diligently, but have not met with it.

PIERIDÆ. The Whites.

6. **Euchloe charlonia pila,** Evans and **doveri,** Evans. The Lemon White. A small yellow or white species with a spotted black apex and solid central spot on the forewing: below the hindwing is green. A yellow form (*charlonia*) flies in N. Africa, Asia Minor to Mesopotamia, where it changes to a white form (*transcaspica*) which prevails in W. Persia: in N.-W. India, Khyber to Campbellpur, there flies a yellow form (*lucilla*). In the Zhob there occurs a rather pale form of *lucilla*, found by Col. Stockley in March and April at Fort Sandeman and Torghar: it differs from *lucilla* in having the dorsum of the forewing below white and I have named it *pila*. I have a pair of the white form (*doveri*) from Mr. G. E. R. Cooper: the male is marked 'Nushki, April' and the female 'Baluchistan', perhaps caught on the Toba Plateau; see a note by Mr. C. Dover on page 1144 of vol. xxviii of the *Journal*, who pointed out the distinctness of this form.

7. **Euchloe belemia,** Esp. The Striped White. Similar to the last, but the hindwing below is striped alternatively green and white. It flies in N. Africa, S. Spain, Asia Minor to Persia. Several specimens were obtained by Mr. W. D. Cumming at Ormarah on the Mekran Coast and are now in the British Museum.

8. **Euchloe ausonia daphalis,** M, and **pulverata,** Christoph. The Pearl White. The underside of the hindwing is green with pearly white spots. The race *daphalis* differs from the other forms of ausonia in missing vein 9 of the forewing: it flies from Chitral to Kunawur: *ausonia* is found in N. Africa, S. Europe to Persia, Central Asia and Siberia. Col. Stockley caught several specimens of *daphalis* on the Torghar in April and I have a male from Mr. Cooper marked 'Burkhi Hill, 7,500 feet, May 1907'. At the end of March I caught a few specimens in the Chiltan forest and in April at Upper Urak: all but one of these have vein 9 present and come nearest to *pulverata*. In this and other instances Baluchistan would appear to constitute the boundary between the Central Asian and Persian fauna.

9. **Pieris chloridice,** Hub. The Lesser Bath White. This and the next two species are very much alike, differing from *Euchlœ* in having irregularly mottled green and white under hindwings, with yellow veins in *glauconome*, a circular white cell spot in *daplidice* and an elongate one in *chloridice*. *Chloridice* is found in the mountains of Europe, Central Asia and Asia Minor, extending to the N.-W. Himalayas, Persia and Baluchistan. It is rather rare in Baluchistan, where I caught a few specimens in Urak and Upper Urak, also on the Mehtarzai Pass in May-June, and a single male at Shingarh in September.

10. **Pieris daplidice moorei,** Rob. The Bath White. Occurs throughout Europe, W. & N. Asia, the N.-W. Himalayas and Baluchistan, where it is common above 5,000 feet from April to September.

11. **Pieris glauconome,** Klug. The Desert Bath White. Occurs in E. Africa, Arabia, Persia, N.-W. India. In Baluchistan I have caught it fairly commonly at Upper Urak and on the Mehtarzai Pass in May and June. It was found at Dalbandin, beyond Nushki in April and at Fort Sandeman in September.

12. **Pieris krueperi devta,** DeN. The Green-banded White. A larger species with a peculiar under hindwing: white crossed centrally by an irregular greenish-black band. The species occurs from Greece to Baluchistan and Central Asia, reaching Chitral and Ladak. It is a rarity: I only obtained one specimen at Ziarat in June and another at Upper Urak in May.

13. **Pieris canidia indica,** Evans. The Indian Cabbage White. This and the next two whites have unmarked undersides and no cell spot on the forewing: *canidia* has marginal spots on the forewing: *brassicœ* is larger with a marginal band: *rapœ* has only a black apex. *Canidia* is a common Himalayan and Chinese insect with a race in the hills of S. India. It is common on Shingarh in July to September and its occurrence there is surprising.

14. **Pieris brassicae,** L. The Large Cabbage White. Occurs commonly throughout Europe, N. and W. Asia and N. India. In Baluchistan it is common in Ziarat, less so at Urak, Shingarh and in Quetta.

15. **Pieris rapae,** L. The Small Cabbage White. Occurs throughout Europe, N. and W. Asia, but in India is confined to the frontier, Baluchistan to Chitral and Ladak. It is the commonest butterfly in Quetta and is found generally throughout Baluchistan over 4,000 feet practically all the year round.

16. **Aporia leucodice balucha,** Marshall. The Baluchi Blackvein. The veins on the under hindwing are conspicuously black. It occurs throughout Central Asia and the Himalayas. It is common at Upper Urak and Ziarat in May and June.

17. **Belenois mesentina mesentina,** Cr. The Pioneer. In addition to the veins on the under hindwing being black, there is a marginal row of black ringed white spots. It is a butterfly of African origin flying throughout the S. Palæarctic zone and all over India except Assam. It is common throughout Baluchistan all the year round.

18. **Catopsilia crocale,** Cr. The common Emigrant.

19. **Catopsilia pomona,** F. The lemon Emigrant.

20. **Catopsilia pyranthe minna,** Herbst. The mottled Emigrant.
These three species are greenish yellow or greenish white: *pomona* has red antennæ: *pyranthe* has a striated underside; in the first two the females are yellow. They are all common throughout the Oriental region and appear as emigrants from the plains into Baluchistan during August and September.

21. **Gonepteryx rhamni rhamni,** L. The Common Brimstone. The male is greenish yellow and the female white with a small reddish spot at the end of the cell on each wing. It occurs throughout the palæarctic zone and along the Himalayas to North Burma. In Baluchistan it is not common, but often seen from April to September at Urak, Ziarat and Shingarh, also occasionally in Quetta and Fort Sandeman. Baluchistan specimens appertain to the European race, rather than to the Indian *nepalensis*, Db., in having smaller cell spots and the narrower (or absent) marginal dark line on the forewing.

22. **Terias hecabe,** L. The Common Grass Yellow. A small yellow butterfly with unspotted black borders and spotted below. It occurs throughout India

and the Oriental region. I have no record of its capture in Baluchistan, but have no doubt whatsoever that it occurs near Sibi and Las Bela, etc.

23. **Colias erate lativita,** M. L. The Pale Clouded Yellow. Typically both sexes have a yellow spotted black border to the forewing: many males have the border unspotted: the yellow colour in these yellow forms is often orange (var. *chrysodona*, Bdv.): many females are white with a white spotted dark border (var. *pallida*, Stg.). The butterfly occurs from S. Russia along the Himalayas, the N.-W. Frontier and the hills of South India. It is common throughout Baluchistan above 3,000 ft. all the year round.

24. **Colias croceus edusina,** But. The Dark Clouded Yellow. Orange with dark borders, which are spotted in the female and the male has a yellow brand at the base of the costa on the hindwing. Occurs throughout the palæarctic zone, along the frontier and Himalayas to Burma. The N.-W. Indian form occurs fairly commonly on the Takhti-Suleiman and Shingarh from May to September and a single male was obtained in Ziarat. It does not seem to occur at all in Western Baluchistan, where one might expect to find the paler European form, *croceus*, Fourcroy.

25. **Ixias pyrene satadra,** M. The Yellow Orange Tip. Yellow with a black-edged orange tip. An oriental butterfly found all over India: odd specimens are to be seen in the Bolan in the Spring and Autumn.

26. **Colotis amata amata,,** F. The Small Salmon Arab. With salmon spots on the border and a black costa to the hindwing. Occurs over most of India. Not uncommon in tamarisk jungle near Sibi in the Autumn and Spring.

27. **Colotis protractus,** But. The Blue Spotted Arab. With bluish spots on the border. Occurs in Western India and with the last near Sibi.

28. **Colotis vestalis,** But. The White Arab. White with a broad white-spotted border. Occurs in Western and Central India: very common at Sibi with *amata*.

29. **Colotis fausta fausta,** Oliv. The Large Salmon Arab. Pale salmon with a salmon-spotted border. Occurs over most of India and westwards to Asia Minor. A few were obtained in the Bolan in October and in the Sheikh Wasl Gorge (Quetta-Nushki road) in September.

30. **Colotis etrida etrida,** Bdv. The Little Orange Tip: otherwise white. Occurs over most of India. Found near Sibi with *amata* and sometimes near Quetta, Upper Urak, etc.

31. **Colotis danae dulcis,** But. The Crimson Tip: otherwise white. Occurs in S. and W. India. Found near Sibi with *amata*, rather rarely.

DANAIDÆ. The Danaids.

32. **Danais limniace mutina,** Fruh. The Blue Tiger. A large dark brown butterfly with large translucent blue markings. A common oriental species occurring throughout India and the East. Stragglers from the plains are not infrequently found everywhere in Baluchistan.

33. **Danais genutia,** L. The Common Tiger. Tawny with a black and white apex and black veins. Also a common Indian and oriental butterfly. I saw one straggler from the plains at Ziarat in July.

34. **Danais chrysippus,** L. The Plain Tiger. Similar to the last species but the veins are not black: the male has 3 and the female 2 black spots on the hindwing. A common African and oriental butterfly found all over Baluchistan practically throughout the year.

SATYRIDÆ. The Browns.

35. **Pararge menava,** M. The Dark Wall. The male is dark brown and the female has a tawny area on the forewing; both sexes have a single ocellus on each wing. It is found in Kashmir and Chitral and in Baluchistan somewhat rarely from April to September above 6,000 feet from the Khojak to Upper Urak.

36. **Pararge schakra,** Koll. The Common Wall. Both sexes like the female of the last species, but on the hindwing there are 3 or more ocelli. It is a common butterfly along the Western Himalayas and is found above Parachinar. In Baluchistan it has only been found at Shingarh commonly in August and September.

37. **Coenonympha myops macmahoni,** Swin. The Baluchi Heath. A small black butterfly with an ocellus on the forewing. *Myops* occurs in Central Asia: *macmahoni* is confined to Baluchistan, where it is frequently met with in the Khojak-Urak area above 6,000 feet from the end of March to early May. I found it very common one year in the Gwal forest at the end of March.

38. **Maniola lupinus centralis,** Riley. The Branded Meadowbrown. The male is dark brown with a broad brand on the forewing and an apical ocellus, replaced in the female by two tawny ocelli on a pale yellow band: the underside is plain. It is a very variable butterfly occurring in several forms from S.-E. Europe to C. Asia, Chitral and the Western Himalayas. In Baluchistan it is common on the Khojak and Bogra passes in June and July.

39. **Maniola narica,** Hub. The Tawny-branded Meadowbrown. Similar to the last but the forewing is tawny and the underside striated. It occurs from S. Russia, through Turkestan and probably Afghanistan to Baluchistan, where it is common in May on the Khojak slopes, Bogra and Murgha Mehtarzai passes.

40. **Maniola wagneri mandane,** Koll. The Oval-spot Meadowbrown. Similar to the last, but has a peculiar elongate black centre to the ocellus on the forewing. It occurs from Asia Minor to Persia. Swinhoe in Lep. Ind. X, 341 stated he had received a pair from Sir H. Macmahon and there is one in the Quetta Museum, all marked Quetta. I have not come across it.

41. **Maniola davendra latistigma,** M. The White-ringed Meadowbrown. The forewing above is tawny in the male with a broad brand: in the female there are two ocelli and only the outer half is tawny: on the underside of the hindwing there are 2 or 3 prominent white-ringed ocelli as in the last species. It flies in various forms from Central Asia through Chitral, Ladak, Khyber, Afghanistan to Baluchistan, where it is very common everywhere above 3,000 feet from May to September.

42. **Maniola tenuistigma,** M. The Lesser White-ringed Meadowbrown. Very similar to the last but smaller, with a narrower brand and a darker underside. It had previously been considered as a variety only but an examination of the genitalia shows that it is specifically distinct. (Uncus short and stout, instead of long and thin.) It is not uncommon above 7,000 feet in June and July at Ziarat, the Khojak and Upper Urak. On examining Chitral specimens I find that the species occurs there at high elevations in a modified form.

43. **Eumenis parisatis shiva,** LeCerf. The White-edged Rockbrown. A large black butterfly with a white border to the hindwing and a striated underside with prominent ocelli. It occurs in Persia, along the frontier and the N.-W. Himalayas. In Baluchistan it is everywhere common above 3,000 feet from May to October.

44. **Eumenis enervata,** Stg. The Dark Rockbrown. A large dark brown species with a white band on the hindwing and on the forewing a black spot surrounded by 4 quadrate white patches. It flies from S. Russia and Asia Minor to Baluchistan, Central Asia and Chitral. It is not uncommon from the end of May to August at Urak and on the Khojak. In Chitral there are two broods, the first brood having tawny instead of white markings. In Baluchistan there is only one brood but occasional specimens are found with tawny markings (var. *analoga*, Alph.)

45. **Eumenis mniszechii balucha,** Evans and **pallida,** Evans. The Tawny Rockbrown. A large dark brown species with a broad tawny band across both wings. It flies from the Caucasus and Asia Minor to Central Asia, the N.-W. Frontier to Ladak and W. China. It is common from June to August at Urak, Ziarat, the Khojak and Bogra, and at Ziarat in May and June (perhaps elsewhere) there is to be met a very pale form. The ordinary local form differs from its allies in the following respects: on the forewing above the

band decreases posteriorly, there is always a lower ocellus and usually two white dots between the ocelli: on the underside of the forewing the central line is clearly marked and the submarginal line is zigzag. The form *pallida*, probably an early brood, has the band very pale brown; forewing below the central line is distinct and the submarginal line sinuous.

46. **Eumenis thelephassa,** Hub. The Baluchi Rockbrown. Very similar to the last; males are distinguished by having a black brand in the cell of the forewing and both sexes by the absence of the dark outer ring to the apical ocellus on the underside of the forewing. It flies from Asia Minor to the Khyber and Baluchistan, where it is very common above 4,000 feet from May to September.

47. **Karanasa actaea nana,** Stg. The Black Satyr. A medium size black butterfly, the forewing being dusky-tawny in the female: the underside of the hindwing is striated and has two outwardly white dark bands. It flies from Europe to Central Asia, Chitral and Baluchistan, where it is not uncommon in July and August over 7,000 feet at Ziarat, Upper Urak and the Bogra.

48. **Aulocera padma burnettii,** Evans. The Great Satyr. A large black butterfly with a broad white band across both wings. It flies in the Western Himalayas and above Parachinar. One male was obtained by Capt. R. R. Burnett at Shinghar at the end of August, where he and I saw another early in September. The local race differs from *padma* in the following respects: forewing more rounded, band wider, 6 mm.: the spot in space 5 on the forewing above absent: the spots in spaces 3 and 4 on the forewing below united.

49. **Ypthima asterope mahratta,** M. The Common Three-ring. A small brown bearing a large tawny ringed black ocellus on the forewing with two bluish white pupils: on the underside of the hindwing there are one upper and two lower minute ocelli. It flies in Africa, Arabia and India. I obtained a single female on the 1st July at 4,000 feet on the road between Ziarat and Loralai.

50. **Ypthima bolanica,** Mar. The Desert Four-ring. Similar to the last, but there are 5 metallic ocelli on the hindwing below. It flies in Kashmir, near Peshawar and in Baluchistan, where it is found everywhere above 3,000 to 6,000 feet from April to August, but only single specimens rather rarely.

NYMPHALIDÆ. The Nymphalids.

51. **Hypolimnas misippus,** L. The Danaid Eggfly. The male is black above with blue reflections and a large white circular patch on each wing. The female is quite different, tawny with a black and white apex to the forewing exactly as in No. 34 *Danais chrysippus*, but with only a single black spot on the hindwing. A common Indian butterfly.

52. **Hypolimnas bolina,** L. The Great Eggfly. The male is similar to *misippus*, but lacks the black spot on the costa of the hindwing below. The female is black with white border spots on the forewing and a white border on the hindwing. A common Indian butterfly extending to the Australian region.

53. **Precis hierta hierta,** F. The Yellow Pansy. A yellow butterfly with black borders and in the male a large blue spot on the costa of the hindwing. A common butterfly throughout India with a race in Africa and Arabia.

Stragglers of the above three species are to be found anywhere in the area in August and September.

54. **Precis orythyia swinhoei,** But. The Blue Pansy. A blue butterfly with black bases, a white apical band on the forewing and two red ocelli on the hindwing. A common oriental butterfly (found also in Arabia and China), which is frequently met with in Baluchistan during the Summer and Autumn. It certainly breeds in the lower parts of the area but is a great wanderer.

55. **Vanessa cardui,** L. The Painted Lady. A pinkish red butterfly with black markings and a white band at the apex of the forewing. It flies all over the world and is common everywhere in Baluchistan throughout the year. Migrations have been observed.

56. **Vanessa atalanta,** L. The Red Admiral. A black butterfly with a red band across the forewing as well as a white band at the apex and a spotted red border to the hindwing. It flies throughout Europe to Mesopotamia and Central Asia (Altai). In India and Burma it is replaced by the closely allied species *indica*, Herbst, from which *atalanta* differs in having a much narrower red band on the forewing and 2, instead of 1, white spots beyond the apical white band. A single specimen was obtained by Col. C. H. Stockley at Shinghar in August 1929 and is a very remarkable capture.

57. **Vanessa egea balucha,** Evans, and **pallida,** Evans. The Eastern Comma. A tawny butterfly with black markings: in the centre of the hindwing below there is a comma-shaped marking. It flies from E. Europe to Persia, C. Asia and along the Himalayas to China in varying forms. In Baluchistan there are two very distinct forms. The dark form *balucha* comes out at the end of June and is common at Ziarat, rarer at Urak; it hibernates through the winter appearing again in the Spring. The pale form *pallida* is less common and is to be found in the same places in May and June. *Balucha* differs from the Summer form *i-album* of *egea* in being bright dark-red with well-defined comparatively small markings and small yellow spots on the dark border of the hindwing. *Pallida* is very much paler above and below: it resembles the spring form *egea* but on the forewing above the black discal spots in spaces 2 and 3 are missing and the yellow border-spots on the hindwing are much larger. *Pallida* is far paler than any other Indian form, but both *pallida* and *balucha* differ from all such in that cell spots on the forewing are not coalesced, but quite separate as in *egea*.

58. **Vanessa xanthomelas fervescens,** Stich. The Large Tortoiseshell. A large tawny red and black butterfly shaped and marked rather like *egea* but with a blue border to the hindwing. Found from Europe to Japan and along the N.-W. Himalayas. I caught a single female, just emerged, at Upper Urak on the 2nd June 1929. It occurs near Miranshah (Tochi).

59. **Argynnis hyperbius,** L. The Indian Fritillary. A large tawny butterfly with dull silvery-bordered black markings on the hindwing below: the female has a broad blue-edged white apical band on the forewing. It flies throughout India to Japan. Stragglers have been caught in the late Summer and Autumn at Shingarh, Ziarat and Urak.

60. **Argynnis lathonia lathonia,** L. The Queen of Spain. A smaller black-spotted tawny butterfly with very large brilliant silver markings on the hindwing below. Flies from Europe to W. China and as the race *issœa*, Db. along the Himalayas. Typical *lathonia* flies in Baluchistan, differing from *issœa* in being smaller, redder, with rounder wings and on the underside of the hindwing in that the discal tornal spot does not extend beyond vein 2. It is common at Ziarat from the end of June to September and is to be seen in the Quetta gardens in the late Autumn and early Spring.

61. **Melitaea trivia persea,** Kollar. The Desert Fritillary.

62. **Melitaea robertsi,** But. The Baluchi Fritillary.

63. **Melitaea didyma dodgsoni,** GrS. The Redband Fritillary.
Small black-spotted tawny butterflies: the underside of the hindwing is white with two reddish bands and covered with black dashes: *trivia* and *didyma* fly from Europe to Persia and Chitral; *trivia* is found in the N.-W. F. Province and the N.-W. Punjab: *didyma* extends to W. China. Though I found these butterflies common from April to June on the Khojak slopes, Gwal Forests, the Murgha Mehtarzai Pass, the Ziarat road near Quetta, Urak and the Chiltan forest, and noted that they seemed very variable, it was not until I dissected a number that I found I had obtained 3 quite distinct species differing as follows:—

(*a*) **trivia** has the hindwing above profusely spotted, which is not the case in the other two. In spaces 2 and 3 of the hindwing below, the red spots of the outer band are inwardly convex, not black-edged but immediately followed by 2 black bars pertaining respectively to the postdiscal and discal rows of black markings, both far removed from the outer black edging of the central red band: in the other two species, discal black markings in spaces 2 and 3 are either absent or much nearer to the central band than to the postdiscal markings, The outer spine of the clasp is no longer than the inner spine, being much longer in the other two species. I found I had only one specimen of *trivia*, caught in May on the Ziarat road.

(*b*) **robertsi** resembles *trivia* very closely. It differs from both species in that the black markings of the postdiscal series on the hindwing below are very prominent and V-shaped instead of nearly straight and on the underside of the forewing towards the apex, the postdiscal spots are conjoined to a continuous line. The outer spine of the clasp is stout and furnished with a second spine below the tip, not simple as in the other species. It is common nearly everywhere, appearing in April and flying till June.

(*c*) **didyma** is larger and more uniform above. It is rather rare on the Khojak and the Murgah Mehtarzai, appearing in May.

64. **Atella phalantha,** Dry. The Common Leopard. A medium-sized black-spotted tawny butterfly, dappled mauve below and a large spot at the tornus on the forewing below. A common Indian butterfly extending to Japan and the Malay Islands. Stragglers are frequently seen anywhere in Baluchistan in the late Summer and Autumn.

LYCÆNIDÆ. The Blues.

(Females of blue species are ordinarily brown, sometimes with red border spots.)

65. **Tarucus theophrastus indica,** Evans. The Painted Pierrot.

66. **Tarucus nigra,** BB. The Spotted Pierrot.

67. **Tarucus mediterraneae,** BB. The Mediterranean Pierrot.

Small tailed blues with white underside to the hindwing covered with short black streaks and a marginal row of metallic spots. The male of *nigra* is always spotted on the forewing above, it is dusky violet blue with a narrow border. The other two have only a cell spot, dusky in *theophrastus*, which has a broad dusky border, while in *mediterraneæ* the border is very narrow and clearly defined and the markings show through from below by transparency. All three species are to be found commonly about highly prickly *Zizyphus* shrubs and trees. *Nigra* is common at old Mach and elsewhere on the Bolan and near Maratangi on the Loralai Fort Sandeman road more or less throughout the year: it also occurs near Peshawar to Kalka and Central India. *Theophrastus* was found near Duki and near Karachi: it flies from Europe to Central India: *mediterraneæ* was found common at Dalbandin in May by Captain D. Harrison: it flies from South Europe to Baluchistan.

68. **Azanus ubaldus,** Cr. The Bright Babul Blue. A small blue with rather elongate wings and a striped and spotted underside: two permanent black tornal spots on the hindwing both sides. It flies throughout India and reaches Arabia. It is to be met with rather rarely throughout Baluchistan from May to September and is most frequently found on tamarisk flowers.

69. **Polyommatus vicrama astabene,** Hemming. The Chequered Blue. Rather dull silvery blue with dusky veins: below greyish white with prominent black spots and a marginal row of orange spots on the hindwing. Occurs from E. Europe to C. Asia, Chitral and Kashmir and to Baluchistan, where it is rather rare, odd specimens having been caught in May to July at Urak and Ziarat. Swinhoe recorded it as common at Kandahar in May and June.

70. **Polyommatus pylaon indica,** Evans. The Baluchi Jewel Blue. A blue with a leaden grey underside and a complete marginal orange-red band: in the male there are traces of an orange spot at the tornus of the hindwing above. It occurs from S.-E. Russia to W. Thibet. In Baluchistan I have found it not uncommon in April and early May on the Murgha-Mehtarzai Pass, Gurlama Pass, Gwal Forest, Khojak slopes and it has been caught in the Hanna valley.

71. **Polyommatus christophi bracteata,** But. The Small Jewel Blue. A small bright blue characterized by having a complete marginal row of metallic crowned orange spots on the hindwing below. It flies in Persia, Turkestan, Chitral and Kashmir. It is to be found in the Quetta-Khojak area about Camelthorn (*Alhagi camellorum*) and is common round the Saranan tank from May to September.

72. **Polyommatus loewii chamanica,** M. The Large Jewel Blue. A large blue with a dusky border: on the hindwing below there are two very prominent orange-crowned metallic spots at the tornal angle. It occurs from Asia Minor to Chitral and Ladak. In Baluchistan it is very common on wild sage from late April to June in the Urak and Gandak valleys, Ziarat, Khojak slopes and the Gurlama Pass as well as elsewhere.

73. **Polyommatus sieversi felicia,** Evans. The Pale Jewel Blue. A very pale lavender blue with a very narrow border and a spot at the end of the cell on the forewing: below very like *lœwii*. *Sieversi* is found from Persia to Turkestan; the race *felicia* from Baluchistan differs in being very much paler and having a narrower border; the female above is very like the next species. A single male was obtained at Upper Urak and a single female on the Murgha-Mehtarzai Pass in May.

74. **Polyommatus hyrcana kwaja,** Evans. The Dark Jewel Blue. The male of *kwaja* above is dark brown rather sparsely overlaid with dark-blue scales leaving a broad border on the forewing and dark marginal spots on the hindwing: the female is similar but the blue scaling is sparser and more basal, the dark marginal spots on the hindwing being obscurely orange-crowned. Below leaden grey: on the forewing the discal spots are large, touching and in an unbroken sinuous line, the submarginal markings narrow and clearly defined: on the hindwing there is a complete submarginal orange band with metallic scales around the 3 or 4 subtornal spots. It differs from the Persian *hyrcana* in being much darker and the discal spots on the forewing below being more regular. About a dozen specimens were obtained in May, June and early September on the Khojak and Bogra, most of them in the Shorgai nallah at Mile 66¾ on the Chaman road.

75. **Polyommatus iris hanna,** Evans. The Jewel Argus. A rather small shining dark-brown insect with a prominent black spot at the end of the cell on the forewing. Below the discal spots on the forewing are very large and on the hindwing the two subtornal black spots are crowned with orange and metallic scales. *Iris* from Turkestan is reddish brown: a dark race *ashretha* flies in Chitral which differs from the Baluchistan race in being bronzy brown above, the discal spots on the forewing below being separate and there being a prominent spot in the hindwing at the base of the cell 1c. *Hanna* is found rather rarely in April and May at Upper Urak, the Gurlama, Murgha-Mehtarzai and Khojak passes and in early September at Ziarat.

76. **Polyommatus cyllarus aeruginosa,** Stg. The Western Green Underwing. Above rather pale shining blue with broad dusky borders; below on the forewing there are very large discal spots: the hindwing is entirely powdered green and is unmarked. It occurs from Europe to Asia Minor and N. Asia. In Baluchistan I have only secured one male and 3 females in April in the Gwal Forest and found it common on the Eastern Khojak slopes before Shelabagh for a fortnight.

77. **Polyommatus bogra,** Evans. The Baluchi Meadow Blue. Male above bright shining blue, veins outwardly black, border narrow and sharply defined, a faint black streak at the end of the cell on the forewing. Below rather dark leaden grey; forewing usually a small spot in the cell, spot end cell and discal spots large, white ringed, latter conjoined in a highly sinuous series; hindwing discal spots in a regular curved line, basal spots prominent, a more or less well-defined white streak from below the cell to the middle of the termen. Double row of grey and white submarginal lunules clearly defined, enclosing very dull orange spots towards tornus on the hindwing. Female above dark shining brown, a prominent black spot at the end of the cell on the forewing: very dusky orange subtornal spots on the hindwing. Expanse 28-34 mm. A number of males and very few females were obtained in June to September on the Bogra, Khojak and Ziarat. A single female was caught by Capt. Burnett at Shingarh in early September. The specimens obtained seem very distinct from any named form.

78. **Polyommatus icarus fugitiva,** But. The Violet Meadow Blue. A bright violet blue species with a sharply defined narrow border. Below grey with small white-ringed black spots and a more or less prominent submarginal

orange band. It occurs throughout the Palæarctic zone entering India in Chitral and Baluchistan, where it is common in cultivated areas (Quetta gardens) above 5,000 feet from March to October: there are probably 3 broods, which do not seem to differ materially.

79. **Polyommatus eros balucha,** M., and **shingara,** Evans. The Common Meadow Blue. *Balucha* is shining silvery blue with a narrow sharply defined border: below similar to *icarus*, the marginal orange band being rather faint and the markings small. *Shingara* is darker shining blue, with broader borders, a spot at the end of the cell on the forewing and more or less well developed submarginal black spots conjoined to the dark border on the hindwing: below darker than *balucha*: usually the orange border is prominent on the hindwing, but sometimes is absent. *Eros* in various forms is found throughout the Palæarctic zone and along the frontier to Murree. *Balucha* is common at Mile 10 on the Urak road from May to September: there are two or three broods exactly alike. I have also caught *balucha* commonly on the Bogra in May to August and Col. Stockley caught a considerable number on Torgarh in April. Of *shingara* Capt. Burnett obtained 3 males and a female and I obtained a male at Singarh about the end of September and a small pale male at Ziarat a few days later.

80. **Chilades laius,** Cr. The Lime Blue. A blue with a white underside and rather blotchy-looking grey and black spots. Found all over India and Burma. Swinhoe records it from Quetta in September. I have not met with it.

81. **Freyeria trochilus,** Frey. The Grass Jewel. A tiny dark-brown insect with a marginal row of brilliant metallic spots on the hindwing below. It occurs from S.-E. Europe to Australia and is to be met with here and there, never very common, all over Baluchistan throughout the year.

82. **Zizeeria maha maha,** Koll. The Pale Grass Blue. Pale and rather dusky blue above with a broad dusky border: below spotted as usual, but with a spot in the cell of the forewing. Found from South Persia throughout Eastern Asia to Japan. I came across it near Duki in June, and nowhere else.

83. **Zizeeria lysimon,** Hub. The Dark Grass-blue. A very small dull blue with dark spots on a grey ground below. It occurs from S. Europe to Australia and is to be found rather rarely anywhere in Baluchistan throughout the year.

84. **Euchrysops contracta,** But. The Small Cupid. A small tailed blue with grey hindwing below traversed by grey catenulated bands and with two metallic-edged black spots about the tail. It flies in Ceylon and India and is to be met with, never commonly, all over Baluchistan throughout the year.

85. **Euchrysops pandava minuta,** Evans. The Plains Cupid. Very similar to the preceding but the spots about the tail are unequal. Found all over India, extending to Malaya. I obtained one specimen of the race *minuta* near Sibi in October: it is a race that is fairly common from Lahore to Peshawar and along the frontier, differing from *pandava* in having the markings on the hindwing below almost obliterated and with a comparatively prominent whitish central band. Swinhoe records a female taken in Quetta in September as *Catachrysops* species near *amyntas*, F., and *comyntas*, God., which may have been this species.

86. **Lampides boeticus,** L. The Peablue. A tailed blue with a striped grey and white underside. It flies throughout the Old World and is common everywhere in Baluchistan all through the year.

87. **Tomares callimachus,** Evers. The Red Copper. Above red with a broad brown border: under forewing pale red with conspicuous black spots and a grey border; under-hindwing grey with narrow dark dashes. It flies from Asia Minor to Persia near the coast, so I was surprised to find it in Baluchistan: a few specimens were obtained round wild almond bushes at 7,000 feet in the Gwal forest and the Murgha-Mehtarzai Pass at the end of March and early April.

88. **Lycaena phlaeas stygianus,** But. The Common Copper. Forewing copper red with large black spots: hindwing with a red border. It flies throughout the Palæarctic zone, along the N.-W. frontier and the Himalayas.

In Baluchistan it is never very common, but is often met with from March to October throughout the area, more particularly in Quetta gardens.

89. **Lycaena thetis lampon,** Led. The Golden Copper. Brilliant golden copper above marked only by the black border in the male, the female being spotted. *Thetis* occurs in Central and Western Asia; there is a tailless race in Chitral at high elevations: *lampon* is tailed. The only specimen I obtained was a male at the Ziarat water-supply intake during my last visit there on the 10th September 1931.

90. **Lycaena phoenicurus,** Led. The Baluchi Copper. A tailed copper: above smoky brown with a purple sheen, the spots from below showing through obscurely: below white with prominent black spots and an orange post-discal band on the wings. It occurs in Persia and C. Asia. In Baluchistan I have caught it sparingly in May and June about the Urak bungalow, near Kahan on the Ziarat road and Malozai on the Speraragha road.

91. **Lycaena caspius susanus,** Swin. The Purple Copper. A very small-tailed dusky copper with a purple sheen; 2 black cell spots on the forewing and one on the hindwing. Below spotted black, the forewing all reddish and the hindwing grey with a discal white band followed by a reddish band. *Caspius* occurs in Turkestan and a tailless race in Chitral: *susanus* seems confined to Baluchistan and the type was caught at Gandak on the Ziarat road in June 1885. I have only secured 2 specimens on the Murgha-Mehtarzai Pass in May. There is a fair series from Gandak on the Ziarat road in the Indian Museum.

92. **Neolycaena connae,** Evans. The Baluchi Hairstreak. Above dark sooty brown unmarked: cilia plain, brown in male, whitish in female: antennæ chequered. Under forewing in male sooty brown, the apex and costa broadly overlaid with grey scales, a grey marginal line: female entirely overlaid with grey scales, with an irregular row of obscure rather small black spots, decreasing to the apex and becoming white-bordered, followed by broad sooty submarginal band decreasing from the dorsum to the middle. Under hindwing entirely overlaid with grey scales, a white line at the end of the cell and a discal series of irregular narrow white lunules, inwardly black-bordered, followed by a series of small submarginal black dots. Expanse 30 to 33 mm. A small series was obtained at 7,000 ft. in the Urak valley, the Mehtarzai Pass and below Ziarat in May and June. A single worn specimen was obtained by Watson at Gandak, on the Ziarat Road, in June 1885 and recorded by DeNiceville in his *Butterflies of India*, etc. vol. iii, p. 65, as *Neolycæna sinensis*, Alph. which differs from *connæ* in having chequered cilia, lacking all the grey scaling below and having submarginal dots on the forewing; *sinensis* flies in Turkestan.

93. **Callophrys rubi,** L. The Green Hairstreak. Brown above and green below. Occurs more or less throughout the Palæarctic region and enters India in Chitral and Baluchistan. In April and May it is quite common near the Urak bungalow and up the valley: odd specimens are to be met with in the Upper Zhob.

94. **Strymon sassanides,** Koll. The Whiteline Hairstreak. Dark brown above, tailed: below brown, both wings crossed by a narrow white line. Occurs in Persia, Afghanistan, Chitral and the Western Himalayas. Common from May to early July at 6,000 to 9,000 feet in the Quetta and Ziarat areas.

95. **Apharitis epargyros,** Evers. The Yellow Silverline. Tawny with black bands above, tailed: below with tawny, silver-centred and black-edged, bands on a white ground. Occurs in Turkestan and Persia and in Baluchistan in common over 6,000 feet above Urak and on the Khojak Pass and Speraragha road.

96. **Apharitis acamas hypargyros,** But. The Tawny Silverline. Similar to the last, but larger: on the under-hindwing the outer discal band from the costa does not turn in and coalesce with central discal band in the middle, but either turns outwards into the submarginal band or ends between the two bands. It occurs in N. Africa, from Arabia to Sind, in the N.-W. Punjab and Chitral. In Baluchistan it is frequently met with all over the area from May to August

HESPERIIDÆ. The Skippers.

97. **Hasora alexis,** F. The Common Banded Awl. A large black skipper with a narrow white band on the hindwing below. Occurs from India and China to Australia. I have caught two stragglers from the plains, one in my garden at Quetta in September and another on the Bogra in August.

98. **Gomalia elma litoralis,** Swin. The African Marbled Skipper. A small marbled greenish brown skipper with a prominent white band on the hindwing. It is an African species with a race (*subfasciata*, M.) found rather rarely in Ceylon and S. India, *litoralis* being confined to Baluchistan and Sind. Swinhoe records it from Quetta: I have only obtained 2 females at old Mach in the Bolan at 3,000 feet.

99. **Syrichtus evanidus,** But. The Sind Skipper. A very small dark brown skipper with white spots, the spot at the end of the cell on the forewing being as large as any other spots: the under-hindwing is greenish with 3 large central white spots across the wing. The type came from the Hubb river in Mekran and it is said to be common at Karachi.

100. **Syrichtus geron,** Watson. The Baluchi Skipper. Similar to the last, larger and the cell spot on the forewing smaller; the under-hindwing varies from pale greenish grey to tawny brown. It occurs in Persia and S. Afghanistan and in Baluchistan is common from May to September at 5,000 to 7,000 feet in the Urak and Ziarat valleys, near Kalat and Raighora on the Ziarat-Loralai road.

101. **Syrichtus orbifer carnea,** Reverd. The Brick Skipper. Similar to *geron* but the cell spot on the forewing is linear and obscure: the under-hindwing varies from dark greenish brown to dark brick red. It occurs from S. Europe to Afghanistan and C. Asia, Chitral. In Baluchistan I have obtained a few specimens from May to July at Upper Urak and Ziarat.

102. **Syrichtus plurimacula,** Christoph (recorded previously as *poggei*, Led). The Streaked Skipper. Similar to the preceding, but the central cell spot on the forewing above is directly over the large discal spot in space 2: the under-hindwing is greenish brown, spotted as usual, but the central spot is produced as a streak to the border. Found in Persia and Mesopotamia. In Baluchistan I have only met with it around a showy red-flowered labiate plant which grows round Smallan to Chotair and Ashgara in the country between Loralai-Ziarat-Dilkhuna. It is common in May and again a second brood in August.

103. **Carcharodus dravira balucha,** Evans. The Tufted Marbel Skipper. A marbled greenish brown skipper with prominently tesselated fringes: greenish olive below and spotted as in *Syrichtus*: It is distinguished from the next by having a thick black brush of hairs on the dorsum of the forewing below near the base. It occurs from Europe to Turkestan, Chitral and Kashmir. I have found it common wherever a tall labiate plant with a white flower and stout leaves grows, particularly around the Urak bungalow up to Upper Urak and at Ziarat. *Balucha* differs from the Kashmir *dravira* in being smaller, paler, more variegated, with pale veins on the forewing above and with narrower and more sharply defined markings on the hindwing below.

104. **Carcharodus alceae swinhoei,** Watson. The Plain Marble Skipper. Very like the last, browner and lacking the tuft in the male. Flies from Europe to C. and W. Asia, Chitral, Kashmir and the Murree Galis. Common from March to October in Quetta gardens and everywhere above 5,000 feet near cultivation: there are probably 3 broods.

105. **Erynnis marloyi,** Bdv. The Inky Skipper. A small black skipper marbled with grey bands on the forewing above and with 3 small apical white spots. Occurs from Europe to C. and W. Asia, Chitral. Fairly common from the end of March to May on the Khojak, Gwal forest, Upper Urak, Mehtarzai Pass and the Ziarat road near Gandak. Curiously enough in Shingarh it flies at the end of August and early September.

106. **Baoris mathias thrax,** Hub. The Small Branded Swift. A dark-brown skipper with a few large white spots on the forewing and some small spots on the hindwing below: the wings are produced and the male has a conspicuous black brand on the forewing above. Flies from Africa and Syria through India,

China and Japan to Australia. I have not found it in Baluchistan, but it is certain to occur in the Sibi and Mekran area: it is common in Karachi.

107. **Gegenes nostrodamus karsana,** M. A rather small dark-brown skipper with pointed wings, unmarked in the male and some dull white spots on the forewing of the female. Flies from Europe and N. Africa to W. and C. Asia, along the frontier, N.-W. Punjab and N.-W. Himalayas. Found rather rarely all over Baluchistan from July to October.

108. **Eogenes alcides alcides,** H. S. The Torpedo. A brown skipper with some rather large white spots on the forewing: the under-hindwing is overlaid grey scales, leaving a row of obscure pale-centred dark spots. Found from Asia Minor to Turkestan, Chitral. Not uncommon in the Urak and Ziarat valleys and near Kach from June to August.

FURTHER OBSERVATIONS ON THE FRESHWATER MEDUSA, *LIMNOCNIDA INDICA*, ANNANDALE.

BY

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(*With a plate and a text-figure*).

The present paper is the result of observations made in the course of a month's tour in the Satara Dt. of the Bombay Presidency in the valleys of the Kistna, Koyna and Yenna rivers. Since the discovery of the Medusa by Agharkar, Annandale (1911), observations have been made on it by Gravely and Agharkar (1912), by Agharkar (1913), by Annandale (1916) and by Hora (1929), but the life-history of the Medusa has remained more or less obscure. The reiterated belief in the occurrence of a fixed hydroid stage in its life-history as it occurs in the allied European and American freshwater Medusa *Craspedacusta*, and the absence in the Indian *Limnocnida* of asexual or vegetative budding so frequently observed in its African relative, *L. tanganicae*[1], and the opinion recorded by Annandale (1919) that a resting stage may intervene in the life-history of the Indian Medusa were my chief inducements to pursue this subject, and it was with a view to verify these observations that a visit to the Satara Dt. was undertaken about the middle of March last year.

My observations were confined to Wai and its vicinity and to Dhom, both on the Kistna river, to the Yenna valley in the vicinity of Medha, Kelghar and Kaner, to the pools in the Koyna river at Bamnoli, and to Karad and its neighbourhood near the confluence of the Kistna and the Koyna rivers. I was able to add only one more locality to Agharkar's list of records, namely, Warunji on the Koyna near Karad. Although Dr. Hora (1926) and myself obtained local information about the occurrence of the Medusa at Wai we have failed to confirm it. It is probable that the Medusae begin to appear much later in the year at Wai than at Dhom only six miles above Wai.

In all the localities mentioned above a very careful examination was made of the bed of the rivers, of the mineral and vegetable contents of the bottom, and of the animal and plant growths on submerged stones and rocks at the bottom and sides.[2] Except at Medha and Rigtawali on the Yenna no organisms were found which may be suspected to be connected with the life-history of the medusa. The minute egg-like bodies found in great numbers at these two places (where the medusae occur in some numbers) which formed the subject of my note in *Nature* (1931), have proved, on further observation in aquaria in Calcutta, to be wholly unconnected with the life-history of the medusae. The mode of attachment of the eggs of the medusae on dehiscence as observed at Karad and recorded in that note is, however, suggestive of the probable life-cycle of this interesting species.

Col. Sewell paid a short visit to Wai, Dhom and Medha during the early part of my tour in Satara Dt., and offered helpful suggestions for which my

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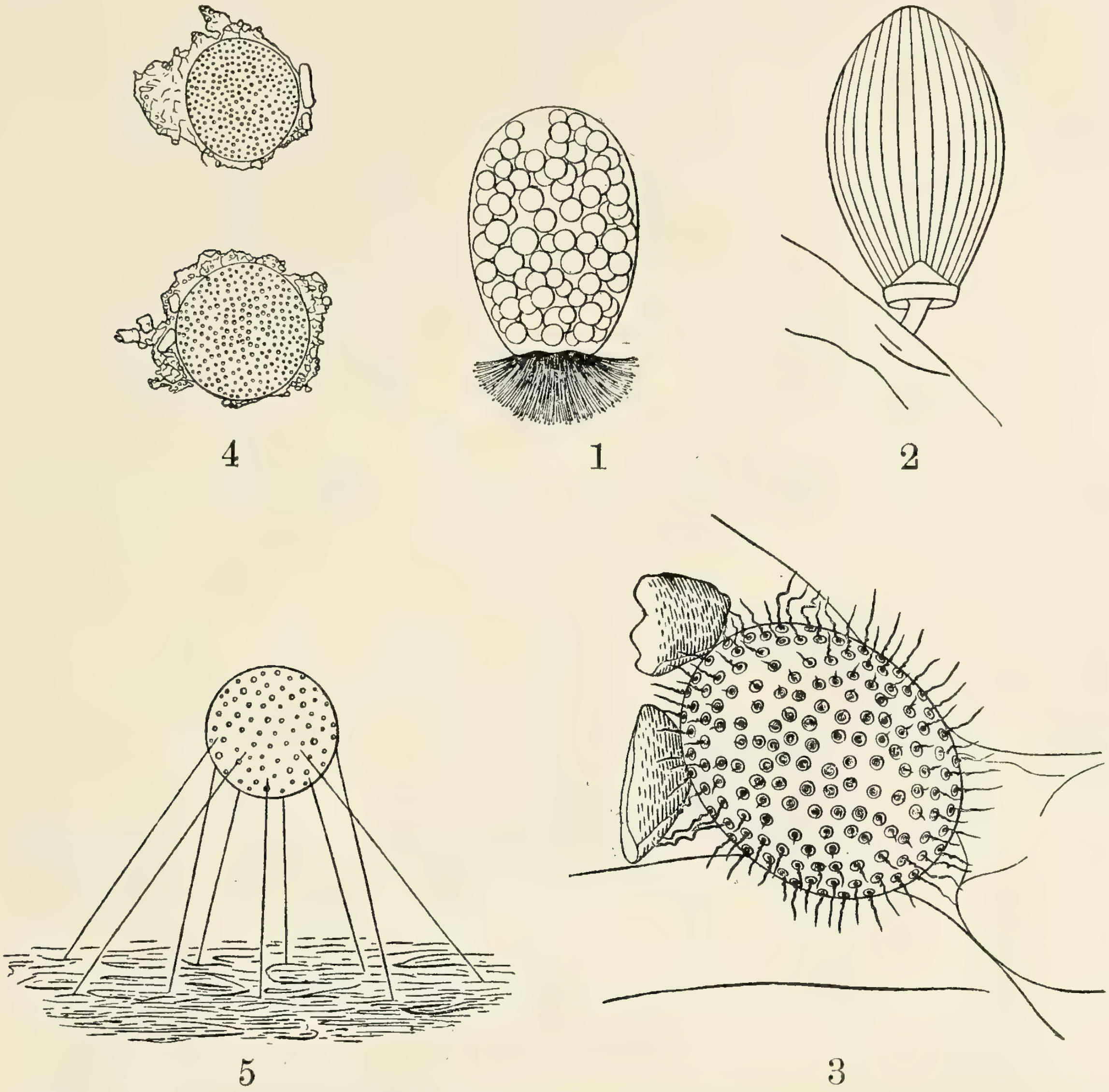
[1] References to this species are given by Gunther (1893), de Guerne (1894) and Browne (1906).

[2] A small sample of the mineral particles at the bottom of the Medha pool contained the following: (1) colourless glassy quartz, (2) red jasper, (3) greenish yellow chalcedony, (4) quartzite with minute inclusions, (5) black magnetite. Of these quartzite seems to be the most abundant and the glassy quartz and magnetite the least. I owe my best thanks to Dr. M. S. Krishnan of the Geological Survey of India for the identification of the mineral particles.

Limnocnida pool, Koyma River, Warunji village, near Karad, Satara District.

2. *Limnocnida* pool in the course of the Yenna River, near Rigtawali, Satara District.

grateful thanks are due to him. I have also to thank my colleague, Dr. Hora whose enthusiastic interest in the problem made it possible for me to visit the areas.



Mode of attachment of the eggs of insects and of *Limnocnida* in streams in the Satara District.

1. Eggs of the May-fly from Medha showing the threads by which it is attached to mineral particles. 2 and 3. Eggs of two different species of insects (?) from Medha showing the mode of attachment. 4. Eggs of *Limnocnida indica* from Karad in the preserved state. The sticky threads are matted together with particles of mineral matter. 5. Eggs of *L. indica* with threads of attachment issuing from its surface as observed in small aquaria at Karad. (From a sketch made in the field).

In the following paragraphs I propose to give a brief account of the habits and habitat of the medusae at various places and to offer a few remarks on the present distribution of *Limnocnida*, and on the origin of the freshwater medusa in India based on the available geological evidence.

Occurrence in the river Kistna.—The course of the river between Dhom, a sacred village on its left bank, and the Shiva temple 3 miles below Wai on the Satara road—a total distance of about 8 miles—was carefully examined for the medusae. The character of the stream and its bed varies to some extent in different places. There are long stretches of sandy bed where the river is broad and broken up into a number of shallow streams, in which the flow is comparatively slow, or into large still, moderately deep muddy pools. Where the bed is rocky and consists of a number of large and small pot-holes there are a few insignificant falls over the projecting shelf-like rocks and a number of rock-pools. Considerably below Wai the stream cuts through massive rocks, where it is narrow and very deep, and its flow is imperceptible.

The surface temperature of water in all these places about the end of March was 24°.3C in the early part of the day and 27°.5C in the afternoon, and the PH value between 7.6 and 8.6. The medusae were only found in the sacred pool of the Kistna at Dhom in this long stretch of 8 miles. They were common here at or near the surface in the early part of the day upto 10 o'clock, but towards midday they seemed to diminish in numbers near the surface. Some of them were sexually mature. The water was distinctly muddy, and the pool seemed to be well-stocked with large fish which were swimming in shoals near the surface. The pool was full of bathers at the time of my visit and was consequently well-stirred. The medusae near the banks were swimming against the slow current, and periodically they seemed to drop passively to the bottom and rest for a while and rise upto the surface. In a stretch of about 500 yards near the sacred temple the medusae were abundant, but both below and above the pool they were scarce indeed.

Although there were several deep pools in the Kistna near Wai no medusae were actually seen, but the local inhabitants, young and old, were positive that they appeared, as a rule, every year from the middle of April to the end of May in the large pool between the Wai bridge and the cremation ground. In 1925 Dr. Hora had likewise been told of their occurrence in the pool by an old fisherman of the locality. The pool was under observation till about the middle of April last year, and was thoroughly dredged with a fishing net at various points. I could not, however, obtain any evidence of the occurrence of the medusa in the pool.[1]

At the instance of Dr. Hora who visited Dhom in 1925, Mr. L. S. Kanitkar, a resident of the village who got interested in the problem, made some observations on the medusae in the following year. The earliest date on which he found the medusae was the 2nd February 1926, and except for a break of about three weeks in that month when he was away, continuous observations were made upto the time of its total disappearance in the last week of May. He tried to breed the medusae in captivity, and commenced work with a dozen of them in a small glass aquarium kept in a cool dark place. With daily changes of water from the river he managed to keep them alive and active for two weeks, although a few died early. He made a second attempt with the same result. On the 7th and 8th of May there were two heavy showers and the water in the river consequently became very muddy, and the medusae were not seen at or near the surface. After two days the water became clear again in the sacred pool and the medusae appeared in great numbers in an active state. Mr. Kanitkar had no means of ascertaining where the medusae had taken shelter during the floods. There was no rain at all between the 9th of May and the 3rd of June of that year, and the water in the pool was perfectly clear, but the medusae disappeared completely during the last week of May for the rest of the year.[2] I take this opportunity to tender my grateful thanks to Mr. Kanitkar for making these observations and for sending us a written account of them.

The sudden and almost total disappearance of the medusae from the sacred pool at the end of the hot weather or just before the break of the monsoon is very curious. It seems probable that after a period of sexual activity the medusae die as the result of the operation of certain physical or physiological factors, leaving behind their eggs which rest at the bottom during the cold season, and develop directly into medusae at the beginning of February or as soon as conditions are favourable for their development. There is at present no evidence to show that a vegetative hydroid stage intervenes in the life-history of the species.

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[1] Moore (1897) states that 'the distribution of *L. tanganicae* in Lake Tanganyika is local and that they are not easy to find except in certain bays where they are observed in large numbers.' Cunnington (1906) stated that 'he was struck by the irregularity in the appearance of the Tanganyika medusa and by the uncertainty of finding it at any particular time or place, and that it was curious that one may be a month or more on the Lake Tanganyika without finding a single specimen'.

[2] This observation is entirely in agreement with that of the Forest Ranger at Medha who found that the medusae disappeared altogether from the pool at Medha about the end of May although the river had been clear for a fortnight after the first heavy shower.

Occurrence in the Yenna river.—The course of the river from about 5 miles below its descent from the Mahableshwar plateau down to Kaner on the Satara road—a total distance of about 15 miles—was surveyed at various likely places between the 28th of March and the 14th of April 1931. The character of the river-bed varies as in the case of the Kistna every few hundred yards of its course. At Kelghar where the ascent of the ghats begins, and some distance both above and below this village the river is very narrow, and its bed is strewn with pebbles and large stones brought down by the floods. At various points where the basaltic substratum is exposed there are fairly deep rock-pools which serve as favourite bathing places for the village folk and their cattle in the neighbourhood. Dr. Agharkar, at the time of his visit to Medha, obtained local information that the medusae occurred in these pools during summer, but did not visit them. On the 1st April last year I examined a number of pools in the neighbourhood of Kelghar, but did not succeed in finding the medusa or any probable stage in its life-history. Some of the old people of the village who were questioned on this subject expressed some surprise that the medusae could ever escape their attention in the pools so frequently visited by them.

In Medha I did not find the medusae till the 10th April although continuous observations were made in the *Limnocnida*-pool at different times of the day. The depth of the pool in April varied from 7 feet at its lower end to 19 feet immediately below the foot-bridge across the river at its upper end. The surface temperature in the same month varied from 24°.3C to 25°C in the early part of the morning to 28°.0C at midday and 27°.0C at 8 p.m. The PH of the water in the pool was 8.2—8.4. The pool is used as a bathing place by the villagers from early morning till abount sunset, and from 11 a.m. to 2 p.m. it is considerably stirred to its depths by the village urchins who dive and chase one another in the water. Although this was happening every day in the pool since my arrival in Medha no medusae were found near the surface or at the bottom. On the 10th April, at about 11 a.m. when the deeper waters had been stirred by the village boys several medusae of various sizes, 5—15 mm. in diameter and of both the sexes were observed coming up to the surface waters. All but the very young stages of the medusae were found. They were kept in several glass receptacles in water from the pool in which they continued to live with daily changes of water for the following four days. There were, however, daily casualties amongst the medusae in the aquaria. Thus out of 35 individuals divided between three aquaria only a dozen were in the normal condition on the third day. The rest were greatly reduced in size, or crumpled and comparatively less active than on the day of capture. At the end of the fourth day the medusae which underwent reduction in size were in a state of collapse. In the active individuals the proximal part of the primary tentacles was more or less swollen and the distal greatly contracted. The bases of the secondary and tertiary series of tentacles were similarly swollen. The gonads were in a poor condition and the mouth was considerably contracted. The yellow bodies commonly present in the circular and the radial canals were found to have disintegrated. At the end of the 5th day only 8 individuals were living. Five of these were feebly active while the remaining 3 were occasionally roused to activity by shaking the container.

On the 11th April and the following days upto the 14th a few medusae continued to come upto the surface, but they were never so abundant as in the sacred pool at Dhom on the Kistna. A few came up along with mud and debris in long conical nets which were dragged on the bottom of the deeper pools.

About 3 miles below Medha and not far from Rigtawali, a village on the Satara road, the Yenna river cuts a deep narrow channel between the vertical sides of basaltic rock. Above the channel the stream is very shallow and the water percolates through its bed of sand and gravel. This shallow portion is followed by a narrow stretch of still water, 2-3 yards long and by a short fall 2 feet high into a circular pot-hole filled with stones and mud. Then commences the long deep pool which has a slightly sinuous course about 100 yards long, 5-15 feet wide and 12-15 feet deep. On either side the rock rises vertically to a height of 30-40 feet. The bed of the pool is rocky in places or is covered with mud and gravel in others. The water is somewhat greenish in colour. There are large fish splashing about at the surface at intervals. The lower end of this pool which is broad and shallow has gravel reaches which give access to bathers. From about 7 o'clock in the morning upto 11 a.m. medusae of both the sexes and of different sizes (5-20 mm. in diameter) were coming up, a few at a time, to the surface. They seemed to come from the bottom, drift along or swim against the gentle current. A long conical net was dragged at the bottom, which brought up a few specimens along with mud and gravel. The temperature of the surface water was 26°.5C at 8 a.m., and the PH was between 7.6 and 7.8.

There seems to be some uncertainty as to the exact season of occurrence of the medusae in the Yenna valley. In 1911 Agharkar found them at Medha in the month of May and in 1912 Gravely and Agharkar found them in abundance in February and March and obtained evidence of their occurrence in the pool till the end of May. Annandale found them in the same pool in March 1918. I failed to find them there till about the middle of April. Local evidence is conflicting on this point. An old resident of Medha who recollected having seen a party 20 years ago in search of medusae and accompanied the late Dr. Annandale in March 1918 on his tour in the Yenna valley said that the medusae failed to appear in certain years following those of exceptionally heavy rain. He had not seen any medusae in the Medha pool for the last six or seven years or in any other pool in the Yenna river round about Medha. He was, however, diffident about the accuracy of his own observation, but was prepared to assert that if in any year the medusae appeared in the Medha pool they may be seen in several other similar pools in the course of the Yenna. As against the evidence of the old resident I have that of the village boys of Medha who never seem to miss their bath in the pool in summer, which goes to show that the medusae appear every summer from April to May. They were, however, not well acquainted with other pools in the Yenna outside the limits of their village.[1]

In 1912 Gravely and Agharkar found the medusae in April at Tambi in the Koyna valley 10 miles across the hills from Medha. My assistant Mr. M. N. Datta visited Bamnoli on the Koyna on the 3rd April 1931 only 5 miles above Tambi where Gravely and Agharkar found them in abundance. Near Bamnoli there were deep pools in places with a gravel bed. The stream at the time of his visit was extremely slow and the water was a deep brown colour due to freshets after the showers of the 31st of March and 1st April. There was very little microscopic vegetation in the pools, but shrimps and small fish were present in great abundance, and insects and their larvae were rare. Mr. Datta did not find any medusae at the time of his visit, but was told by the residents of the village that they usually appeared in the height of summer about the middle of May. At Kaner, 8 miles below Medha on the Satara road where several deep pools are present in the course of the Yenna Mr. Datta found no trace of the medusae.

Occurrence in the Koyna river near Karad.—In May 1913 Agharkar searched for medusae in the Kistna and Koyna rivers near Karad on obtaining local information of its occurrence there, but failed to find any. The Kistna and the Koyna rivers unite to form the Kistna near Karad, about 32 miles south of Satara, the headquarters of the district of that name. I made a careful search for the medusae in the Kistna in the month of April both above and below Karad without success. Near Warunji, a village 2 miles south of Karad on the left bank of the Koyna, *Limnocnida indica* was first observed by me on the 5th April a little before dusk. On the following two days I found several examples a little below the village in the early part of the day. The bed of the river was over 100 yards wide opposite the village and consisted of sand and small pebbles for the most part. The stream was narrow (about 15 yards wide and 3-5 feet deep in various parts of it) and running close to the left bank. Grass and a few aquatic plants were found near the edge of the stream. In about 3 feet of water near the edge of the stream where the current was very slow in a stretch of water about 50 yards long and 20 yards wide which was used as the village bathing pool I found the medusae swimming near the surface. They were of various sizes (5-25 mm. in diameter). In very shallow water north of the village the medusae were scarce, but a few stragglers were found entangled in the aquatic vegetation. These had apparently been washed away accidentally from the quiet waters of the pool into the flowing part of the stream during the floods of the 1st of April. To the inhabitants of the village they were known as 'Phodi' or 'Phode' (meaning small-pox) presumably on account of their small rounded shape resembling pox-marks. Some of them thought that they were responsible for certain intestinal troubles if accidentally taken in. The villagers were positive about their occurrence in the pool near their village in the months of April and May.

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[1] This curious uncertainty of the behaviour of freshwater medusae has been noted in the case of the American *Craspedacusta ryderi* Potts by White (1930) and by Payne (1924).

Some individuals of both the sexes obtained on the 6th April in the pool near Warunji were kept under observation in a cool dark place in small glass bowls, and were examined under the binocular microscope every hour. They were found to be active and healthy throughout the day of capture. Towards the evening of the same day a relatively less active gravid female settled down at the bottom of the bowl discharging its minute eggs. Owing to the currents set up by the movements of the other medusae the eggs were scattered all over the bottom, but were attached by means of very minute short sticky threads from the surface of the eggs which came into contact with the bottom of the bowl. Some were accidentally attached to the surface of the umbrella of the swimming medusae. Each of the attached eggs thus resembled a baloon held in position by a number of ropes. The eggs are 0.057-0.085 mm. in diameter, and have a thin apparently chitinous covering and a number of transparent spherical granules loosely floating in the viscous fluid which forms the contents of their interior. This device by means of which the eggs are fixed seems to suggest a clue to the probable fate of the medusae during the unfavourable season when the physical conditions in the river are inimical to their existence. In their natural environment they probably lie at the bottom amongst crevices in rock-pools or between particles of grit, sand or gravel, attached to them by their sticky threads, and begin to develop at the commencement of the next favourable season, ultimately liberating the medusae about the beginning of February.

In the course of examination of the contents of the bottom of various pools in the Yenna and the Koyna rivers I found certain minute eggs which at first escaped notice amongst the dark gritty material and both in size as well as in external features they closely resembled the eggs of the medusae observed at Karad. The sticky threads from their surface seemed, however, to have formed a matted tangle with minute inclusions of mineral or vegetable debris. and constituted a separate protective layer. In addition to the eggs which were presumably those of the medusae I found several which seemed to be the eggs of various insects. The eggs of at least three different species of insects with different devices for fixation were obtained in the Yenna river near Medha. Those of a species of Mayfly were the most abundant in the pools at Medha and Rigtawali. Amongst the contents of the bottom debris I failed to find any organism which could be the hydroid stage of the medusae.

Asexual budding by proliferation from the margin of the umbrella which is an important feature in the life-history of *Limnocnida tanganicae* has not been observed hitherto in the Indian *Limnocnida*. It seems to me that this mode of reproduction is altogether absent in the Indian species, as the many hundreds of medusae examined on various occasions were without any trace of the vegetative buds.

Several years before the discovery of *Limnocnida indica* in the Yenna river, Alcock (1911) observed and handled a solitary specimen of freshwater medusa in a big tank at Purulia in Chota Nagpur, and suggested that they may occur also in the rivers of Chota Nagpur. It has not been seen again although at different times visits have been paid to this tank in recent years by my colleagues and myself in the Zoological survey. It is therefore impossible to say if the medusa observed by Alcock was specifically or even generically related to the Indian medusa of the Western Ghats.

While in Karad in May 1913, Agharkar was informed of the occurrence of a species of freshwater medusa in the Varna and the Panchganga, tributaries of the Kistna river. Neither he nor I was able to visit these streams. In November 1928 Dr. Prashad and myself investigated the fauna of the Malprabha and Ghatprabha rivers in the Belgaum Dt., also tributaries of the Kistna, but failed to find any evidence of their occurrence in these streams. During my visit to the Shimoga Dt. of Mysore early in January 1929 I made an unsuccessful search for the medusae in the Tunga and the Bhadra rivers which after union in Mysore territory empty themselves into the Kistna. We know as yet very little about the distribution of the medusa in India, and much less about the proper season in which it flourishes in the various streams in which they are reported to occur.[1]

Distribution of Limnocnida.—The genus has been recorded hitherto in the river Niger in N.-W. Africa, in the lakes of Tanganyika and Victoria Nyanza in the Central African rift valleys, in the Hunyani river, a southern tributary of the Zambesi, and in the Norquane river, a tributary of the Limpopo in Rhodesia, and in the Yenna, Koyna, and Kistna rivers on the eastern slopes of the Western ghats of India.[2] As to the occurrence of this medusa of unquestionable marine origin in the rivers and lakes of the two great continents of Africa and India there is possibly one explanation, that is, that the ancestors of *Limnocnida* have passively migrated from an ancient sea, parts of which were cut off from the ocean as the result of seismic disturbances, and acclimatised themselves to changes incidental to the gradual conversion of an inland sea into freshwater areas. There seems to be sufficient palæontological evidence to warrant the assumption of the existence of a vast sea in Eocene times which extended across Northern and Central Africa to India and receded later on with the remnants of a fauna peculiar to that period.

The area in which the Indian medusa occurs belongs to the Deccan trap, and there seems to be little evidence in favour of the hypothesis that the trap was originally deposited in the sea. 'With the exception of the Bagh beds in the western part of the Nerbudda valley and of the Rajahmundry beds in the Godavari delta in which estuarine and freshwater organisms have been found, the intertrappeans from the source of the Nerbudda in the East to Bombay on the West, and from Gwalior in the North to Belgaum in the South, are distinctly freshwater and mostly lacustrine.' No marine organism seems to have been found in them. Although 'the saltness of part of the Berar plain seems in favour of the presence of the sea at the period of its formation, the want, so far as is known, of marine remains is opposed to the idea of these plains having been delta accumulations on a sea-coast'. On the other hand there seems to be clear evidence of the Konkan and the Sahyadri range having been subjected to forces of subærial and marine denudation.[3]

From the known distribution of the medusa in India and from the nature of the geological evidence available we must rule out the possibility of its migration from the Bay of Bengal up the rivers to their very source near the Western ghats, unless we are prepared to agree with Hislop that the whole of central and western India was an immense lake communicating with the sea to the eastward near Rajahmundry, and that certain marine organisms acclimatised themselves in this huge backwater. Unfortunately for this theory there seems to be little geological evidence to prove the existence of a vast lake in central and western India.[4] There is, however, abundant evidence to show that the ancient Indian peninsula proper was washed on its northern shores by the waters of a huge shallow sea up to the end of the cretaceous age, and that the shrinkage of this vast sea as a result of the upheaval of the Himalayas did not commence till the Eocene period. According to the displacement theory of Wegener (1924) India and Africa were united till the close of the secondary period, and the great inland sea north of the Indian peninsula was connected with the African Eocene sea across modern Arabia, and central and south-east Africa. It would appear that the present coast line of Western India was not formed till Pliocene times and that the configuration of the Western Ghats was not changed till after the close of this period[1].

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[1] Prof. Yeolekar of the Fergusson College, Poona, collected in the month of December 1931 a few specimens of Freshwater medusae from a step-well on the outskirts of Poona city. The well was without any connection with streams in the neighbourhood. The medusae were exhibited by him before the Zoology section of the Indian Science Congress held at Bangalore in January 1932. They resemble the examples from the rivers in the Satara District in several features. Pro. Yeolekar and his pupils are, I understand, making further observations on the medusae from the freshwater well.

[2] It is not known whether the medusa recorded by Arnold (1913) in the Norquane river belongs to this genus. It is probably related to *L. rhodesiæ*.

[3] For details of the geological history of peninsular and Western India see Carter (1857), Blanford (1869), Foote (1876), Wadia (1926), and Wait (1930).

[4] The freshwater medusa observed by Alcock (1911) in a tank in Purulia and believed by him to be widespread in the rivers of Chota Nagpur is presumably a descendant of the emigrants from the Eocene seas on the northern side of the Indian peninsula. It has not been rediscovered since 1879.

With the Indian peninsula, namely, the modern Deccan washed by seas on the North and on the West, and with the cessation of the trap flows in early Eocene times followed by a period of quiescence in which the fauna had time to settle, the ancestors of the genus *Limnocnida*, which was probably widespread in the Eocene seas, had the opportunity to passively migrate into the estuaries of the then coast line of western India, and thence into a series of hollows of the traps which probably constituted the bed of the rivers which flowed into those seas. As a consequence of the gradual changes in the configuration of the Sahyadri range the drainage area of these rivers was presumably subjected to considerable alterations with the result that the ancestors of *L. indica* were cut off from their marine home, and gradually adapted themselves to conditions of life in freshwater pools in the course of the rivers[2]. The seasonal rains and floods which brought down enormous quantities of mud, gravel and other mineral debris probably drove them to sheltered spots in the course of the rivers, which were apparently very numerous in the trap area. The medusae thus sheltered during the unfavourable season survived and gradually spread down the rivers. During the dry season when favourable conditions prevailed, sexual reproductive activity was at its height, and the eggs discharged were effectively prevented from being washed away with the strong currents by a special fixation device. It is probable that the progeny of each year was killed outright by the violence of the floods, and the species had, in order to survive, necessarily to complete its development and to reproduce within those few months of the dry season.

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[1] Blanford (1863) said with reference to the occurrence of *Cremnoconchus syhadrensis* (Blanford), a Littorinid of distinct marine origin, on the Western Ghats that 'no question can exist as to the Western Ghats having formed a marine cliff in comparatively recent geological times. This species occurs 30-50 miles from the sea on precipices or on steep hillsides where water runs over rocks during rains'.

[2] The occurrence of *Craspedacusta ryderi* (Potts) in Kentucky river, U.S.A., is explained by Payne (1926) who says that Kentucky has been part of the sea, and that the medusae were presumably cut off from the main sea during the period of elevation of this region, and were able to adapt themselves to the slow changes in the salinity of water.

EARTH-EATING AND SALT-LICKING IN INDIA.

By

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and

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ANALYSES XIV—XXV.

XIV. Soil from Salt-Lick.

Serial No. 18.

Locality—Barkot Shooting Block, Dehra Dun.

Obtained and sent by—Mr. C. Wilson, Dehra Dun, U.P.

Buffy hard clayish lumps. Powder rough; finer portions soapy.

Minerals	0·50	per cent.
Clay	21·73	,,
Sand	71·87	,,
Organic debris	1·38	,,
Moisture	2·66	,,
Fine Earth (20 mesh sieve)	96·84	,,
Insoluble in nitric acid	85·142	,,
Potash (K_2O)	0·807	,,
Magnesia (MgO)	0·570	,,
Lime (CaO)	0·273	,,
Alumina (Al_2O_3)	2·552	,,
Silica (SiO_2) soluble	2·396	,,
Phosphorus (P_2O_5)	0·076	,,
Manganese (Mn)	0·016	,,
Ferric oxide (Fe_2O_3)	3·260	,,
Moisture and organic matter	0·900	,,

Remarks.—1. The soil contains traces of sodium and chlorine.
2. The lick is frequented by chital and sambar.

XV. Soil from Salt-Lick.

Serial No. 19.

Locality—Kalsi, on the Road to Chakrata, Dehra Dun.

Obtained and sent by—Mr. C. Wilson, Dehra Dun, U.P.

Hard pinkish or purplish lumps; some of them flinty, others friable.

Clay	3·58	per cent.
Sand	77·99	,,

Fine Earth	100·000	per cent.
Insoluble in nitric acid	71·516	,,
Soda (Na_2O)	0·081	,,
Potash (K_2O)	6·088	,,
Magnesia (MgO)	1·326	,,
Lime (CaO)	6·863	,,
Alumina (Al_2O_3)	3·904	,,
Carbon dioxide (CO_2)	7·430	,,
Silica (SiO_2) soluble	1·180	,,
Phosphorus (P_2O_5)	0·930	,,
Ferric oxide (Fe_2O_3)	1·358	,,
Moisture and organic matter	0·708	,,

Remarks.—1. The soil contains traces of sulphur and manganese.

2. The lick is used by cattle.

XVI. Soil from Salt-Lick.

Serial No. 81.

Locality—Kashmir Game Rukhs.

Collected and sent by—The Deputy Controller, Kashmir Rukhs, Kashmir.

Greyish black earth with straw, rootlets, and numerous pellets of dung. Powder gritty.

Minerals and detritus	3·20	per cent.
Clay	14·76	,,
Sand	65·00	,,
Organic debris	8·52	,,
Humus	0·78	,,
Moisture	2·84	,,
Fine Earth (20 mesh sieve)	95·16	,,
Insoluble in nitric acid	74·925	,,
Potash (K_2O)	8·900	,,
Magnesia (MgO)	0·758	,,
Lime (CaO)	0·966	,,
Alumina (Al_2O_3)	2·632	,,
Silica (SiO_2) soluble	1·660	,,
Phosphorus (P_2O_5)	0·099	,,
Ferric oxide (Fe_2O_3)	2·289	,,
Moisture and organic matter	2·840	,,

Remarks.—The soil contains traces of sodium and manganese.

XVII. Soil from Salt-Lick.

Serial No. 82.

Locality—Kashmir Game Rukhs.

Collected and sent by—The Deputy Controller, Kashmir Rukhs, Kashmir.

Buffy hard clayish lumps. Powder rough.

Minerals and detritus	0·09	per cent.
Clay	27·91	,,

Sand	57·99	per cent.
Organic debris	1·79	,,
Moisture	1·76	,,
Fine Earth (20 mesh sieve)	97·20	,,
Insoluble in nitric acid	75·866	,,
Potash (K_2O)	3·789	,,
Magnesia (MgO)	1·719	,,
Lime (CaO)	6·248	,,
Alumina (Al_2O_3)	1·744	,,
Silica (SiO_2) soluble	2·296	,,
Phosphorus (P_2O_5)	0·152	,,
Ferric oxide (Fe_2O_3)	0·400	,,
Moisture and organic matter	1·840	,,

Remarks.—The soil contains traces of sodium, manganese and carbon dioxide.

XVIII. Soil from Salt-Lick.

Serial No. 8.

Locality—Pharenda Forest Range, Gorakhpur, United Provinces.

Obtained and sent by—The Divisional Forest Officer, Gorakhpur.

Buffy (yellowish) hard clayish lumps. Powder soft.

Minerals and detritus	3·03	per cent.
Clay	20·50	,,
Sand	68·91	,,
Organic debris	0·85	,,
Moisture	0·12	,,
Fine Earth (20 mesh sieve)	95·04	,,
Insoluble in nitric acid	82·480	,,
Potash (K_2O)	3·664	,,
Magnesia (MgO)	1·359	,,
Lime (CaO)	0·336	,,
Alumina (Al_2O_3)	2·416	,,
Silica (SiO_2) soluble	0·874	,,
Ferric oxide (Fe_2O_3)	3·290	,,
Moisture and organic matter	0·860	,,

Remarks.—The soil contains traces of sodium, manganese and phosphorus.

XIX. Common Earth.

Serial No. 9.

Locality—Pharenda Forest Range, Gorakhpur, United Provinces.

Obtained and sent by—The Divisional Forest Officer, Gorakhpur.

Greyish powder and grey clayish lumps breaking easily. Powder soft.

Minerals and detritus	0·70	per cent.
Clay	3·75	,,
Sand	82·98	,,

Organic debris	0·64	per cent.
Humus	0·89	,,
Moisture	2·24	,,
Fine Earth (20 mesh sieve)	97·96	,,
Insoluble in nitric acid	81·108	,,
Potash (K_2O)	3·538	,,
Magnesia (MgO)	0·663	,,
Lime (CaO)	0·476	,,
Alumina (Al_2O_3)	2·780	,,
Silica (SiO_2) soluble	1·987	,,
Phosphorus (P_2O_5)	1·070	,,
Ferric oxide (Fe_2O_3)	0·643	,,
Moisture and organic matter	6·220	,,

Remarks.—1. The soil contains traces of sodium and manganese.

2. The earth was taken from an area adjoining Salt-Lick No. 8.

XX. Soil from Salt-Lick.

Serial No. 10.

Locality—The Keolapur low-lying grassy area, Lachmipur Forest Range, Gorakhpur, United Provinces.

Obtained and sent by—The Divisional Forest Officer, Gorakhpur, United Provinces.

Hard grey lumps with rootlets. Powder rough.

Minerals and detritus	0·11	per cent.
Clay	28·20	,,
Sand	63·30	,,
Organic debris	2·70	,,
Humus	1·15	,,
Moisture	2·12	,,
Fine Earth (20 mesh sieve)	97·47	,,
Insoluble in nitric acid	82·740	,,
Soda (Na_2O)	0·159	,,
Potash (K_2O)	7·062	,,
Magnesia (MgO)	0·663	,,
Lime (CaO)	0·525	,,
Alumina (Al_2O_3)	2·430	,,
Phosphorus (P_2O_5)	0·580	,,
Ferric oxide (Fe_2O_3)	3·753	,,

Remarks.—The soil contains traces of silica (soluble), manganese, moisture, and organic matter.

XXI. Soil from Salt-Lick.

Serial No. 11.

Locality—Lachmipur Forest Range, Gorakhpur, United Provinces.

Obtained and sent by—The Divisional Forest Officer, Gorakhpur, United Provinces.

Hard yellowish grey lumps. Powder rough.

Minerals and detritus	0·88	per cent.
Clay	16·12	,,

Sand	79·86	per cent.
Organic debris	4·44	,,
Humus	0·37	,,
Moisture	0·97	,,
Fine Earth (20 mesh sieve)	97·460	,,
Insoluble in nitric acid	81·288	,,
Potash (K_2O)	9·997	,,
Magnesia (MgO)	0·395	,,
Lime (CaO)	0·329	,,
Alumina (Al_2O_3)	1·280	,,
Silica (SiO_2) soluble	0·286	,,
Phosphorus (P_2O_5)	0·199	,,
Ferric oxide (Fe_2O_3)	2·145	,,

Remarks.—1. The soil contains traces of sodium, sulphur, manganese, moisture, and organic matter.

2. The lick lies in the Lachmipur beat.

XXII. Common Earth.

Serial No. 12.

Locality—Lachmipur Forest Range, Gorakhpur, United Provinces.

Obtained and sent by—The Divisional Forest Officer, Gorakhpur, United Provinces.

Hard greyish pellets with rootlets. Powder rough.

Minerals	0·36	per cent.
Clay	6·50	,,
Sand	83·59	,,
Organic debris	1·41	,,
Humus	0·47	,,
Moisture	1·18	,,
Fine Earth (20 mesh sieve)	98·452	,,
Insoluble in nitric acid	85·532	,,
Potash (K_2O)	6·822	,,
Magnesia (MgO)	0·343	,,
Lime (CaO)	0·289	,,
Alumina (Al_2O_3)	1·060	,,
Silica (SiO_2) soluble	1·400	,,
Sulphur (So_3)	0·024	,,
Phosphorus (P_2O_5)	0·298	,,
Ferric oxide (Fe_2O_3)	1·787	,,
Moisture and organic matter	0·875	,,

Remarks.—1. The soil contains traces of sodium, chlorine, and manganese.

2. The earth was taken from an area adjoining Salt-Lick No. 10.

XXIII. Soil from Salt-Lick.

Serial No. 22.

Locality—Ngawun Reserved Forest, Mergui District, Lower Burma.—Lat. 11°38' N.; Long. 99°15' E.

Collected and sent by—The Divisional Forest Officer, Mergui, Lower Burma.

Friable clayish lumps, yellow outside, grey inside; rootlets. Powder slightly gritty.

Minerals	0·42	per cent.
Clay	28·17	,,
Sand	67·04	,,
Organic debris	0·16	,,
Moisture	0·23	,,
Fine Earth (20 mesh sieve)	97·509	,,
Insoluble in nitric acid	84·360	,,
Potash (K_2O)	4·674	,,
Magnesia (MgO)	0·136	,,
Lime (CaO)	0·112	,,
Alumina (Al_2O_3)	3·120	,,
Silica (SiO_2) soluble	0·070	,,
Phosphorus (P_2O_5)	0·265	,,
Ferric oxide (Fe_2O_3)	2·717	,,
Moisture and organic matter	1·880	,,

Remarks.—1. The soil contains traces of sodium and manganese.

2. Fifteen separate licks were found in an open grassy 'Kwin', 100 acres in extent and surrounded by dense forest.

3. The licks are visited principally by elephants all the year round, and by bison during the rains. Bisons eat the soft earth when the holes are flooded with water. Elephants appear to visit mostly during the dry weather grinding the hard earth away with their tusks or tushes.

XXIV. Soil from Salt-Lick.

Serial No. 231.

Locality—Near Horse Creek, Salmon River, Idaho, U.S.A.

Collected and sent by—Col. R. Sparrow, The Lodge, Colne, Essex, England.

Buffy earth with quartz and felspars. Powder gritty and soapy.

Minerals	57·50	per cent.
Clay	4·47	,,
Sand	33·37	,,
Organic debris	0·62	,,
Moisture	2·40	,,
Fine Earth (20 mesh sieve)	40·100	,,
Insoluble in nitric acid	30·683	,,
Soda (Na_2O)	2·510	,,
Potash (K_2O)	2·691	,,
Magnesia (MgO)	0·524	,,
Lime (CaO)	0·176	,,
Alumina (Al_2O_3)	1·350	,,
Silica (SiO_2) soluble	0·320	,,
Phosphorus (P_2O_5)	0·194	,,

Ferric oxide (Fe_2O_3)	1·358	per cent.
Moisture and organic matter	0·444	,,

Remarks.—1. The soil contains traces of chlorine and manganese.

2. The lick is frequented by Bighorn Sheep, Black-tailed Deer, and possibly by Rocky Mountains Goat at times.

3. The sample was taken on October 30, 1929, after a very dry summer and dry Fall.

XXV. Soil from Salt-Lick.

Serial No. 156.

Locality—Two miles west of Nagerhole Forest Rest House, South Coorg.

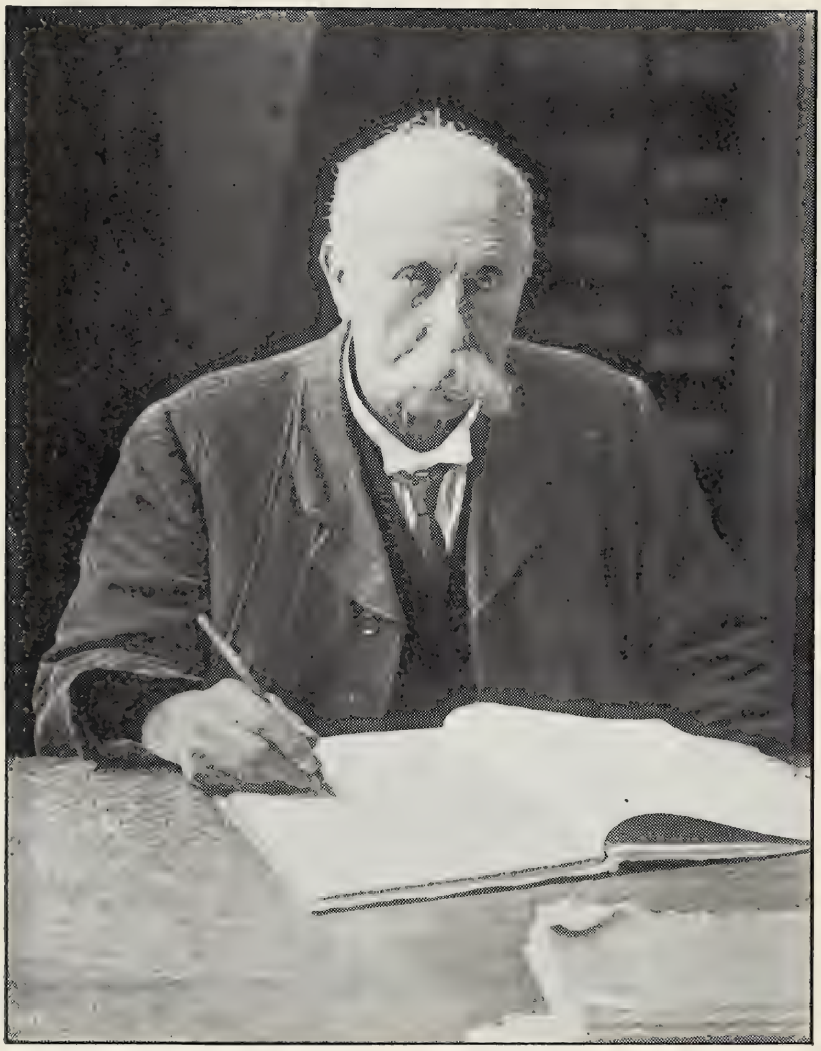
Collected and sent by—G. Robinson, Esq., Chief Forest Officer, Mercara, Coorg.

Very dark grey clayish lumps. Powder rough.

Minerals	3·22	per cent.
Clay	22·01	,,
Sand	70·36	,,
Organic debris	0·72	,,
Humus	0·46	,,
Moisture	3·27	,,
Fine Earth (20 mesh sieve)	93·507	,,
Insoluble in nitric acid	77·840	,,
Potash (K_2O)	5·580	,,
Magnesia (MgO)	0·260	,,
Lime (CaO)	0·294	,,
Alumina (Al_2O_3)	4·372	,,
Silica (SiO_2) soluble	0·019	,,
Phosphorus (P_2O_5)	0·128	,,
Manganese (Mn)	0·010	,,
Ferric oxide (Fe_2O_3)	1·859	,,
Moisture and organic matter	3·220	,,

Remarks.—The soil contains traces of sodium.

(*To be continued*).



Mr. Thomas Burgess Fry.
(*Born 8th July* 1850; *died 20th November* 1931).

OBITUARY.

Thomas Burgess Fry, 1850-1931.

To a great majority of Members of the Bombay Natural History Society, Mr. Thomas Burgess Fry, who died on November 20th, 1931, aged 81, will only be known as the author, in conjunction with Mr. M. A. C. Hinton and the late Mr. R. C. Wroughton, his brother-in-law, of several reports, published in this Journal, on the collections made by the Mammal Survey of India, which was inaugurated and maintained by the Society.

He was the son of Robert Burgess Fry and Jemina *née* Baldock and was born at Crowborough, Sussex, on July 8th, 1850. He entered the Indian Forest Service (Bombay); and soon after his retirement in July 1905 he joined Mr. Wroughton, who was working at the Natural History Museum in London and helped him most efficiently in the sorting, cataloguing, identifying, and subsequent dispersal to various Museums of the vast collection of skins and skulls procured by the Survey-collectors and sent to England for those purposes.

Although to begin with he had only a general familiarity with the Indian fauna, such as most sportsmen possess, and was wholly without zoological training, he applied himself diligently to acquiring the technical knowledge necessary for the determination of the species, to the extent even of learning the structural details of the skulls and teeth of obscure groups, like the Bats, Shrews, and Mice, in which he had previously taken little interest.

After Mr. Wroughton's death, he carried on the task single-handed, regularly putting in some six hours work on five days of the week, the odd week-days being set aside for golf at which, considering his years, he was wonderfully adept. This routine was broken only by a summer holiday, usually in Scotland, and by such recreations as the University boat-race, cricket matches at Lords and the Oval, and billiard contests. Himself an athlete of considerable physical vigour in his young days, he kept up his interest in games and sports to the last, and died suddenly as he would probably himself have chosen to die in the middle of a round on the golf course. He was buried at Ealing Cemetery alongside his relative and life-long friend and colleague, R. C. Wroughton.

Only a few days before his death he handed to Mr. Hinton for revision the report upon the Mammals of the Eastern Ghats. Appropriately then might he have exclaimed '*Nunc dimittis*', for this collection was the last of the Survey work in the field, at all events for the time being. It will be impossible to replace him and he is grievously missed at the Museum, not only because his indispensable work there has come to an end, but because his placid, kindly, cheerful and courteous disposition endeared him to all with whom he came in contact.

The photograph, showing Mr. Fry at his work in the Museum, was taken during the summer of 1926 by Mr. Hinton.

R.I.P.

AN APPEAL TO ANGLERS.

The Editor,
Bombay Natural History Society,
Bombay.

Dear Sir,

May I appeal to all Angling Members of the Society through the Journal for any information they can give me on Fishing Localities in India and Burma. With the disadvantage of limited movements as in my present position it is impossible to get in touch with even a small proportion of the Angling Community in this vast country. I have in mind as you know the publication of a book dealing with the fishing localities in India and Burma, brought up to date from the date of the last book published, Skene Dhu's *Anglers in India*, 1923. Any notes on fishing in any of these localities, or new ones not hitherto mentioned, and of general interest to all keen anglers will be included and published either under the name of the contributor or his nom-de-plume, whichever he prefers.

Sketches of good spots or lettered maps will be of general interest and gratefully received, as well as any type of fishing, Sea, Estuary, Tank or Mahseer, with as full notes of the means of getting to such places.

Thanking you,
I am yours faithfully,
A. MACDONALD.

Ryam Factory P.O.,
Dist. Darbhanga.

REVIEWS.

HAND-LIST TO THE BIRDS OF SAMOA. By John S. Armstrong, M.B. Pp. i-iv, 1-91, London: Bale, Sons & Danielsson, 1932.

Dr. J. S. Armstrong accompanied Dr. P. A. Buxton and Mr. G. H. G. Hopkins on a research expedition to Samoa sent out by the London School of Tropical Medicine, and in spite of his medical duties found time to pay attention to the birds.

Samoa was discovered by the famous French navigator, de Bouganville,—after whom the well-known genus of plants *Bougainvillea* was called,—and in his account of the voyage are the first notes on the birds of these islands. Various naturalists have paid visits to this group from time to time but few have given much attention to the habits of the indigenous species, and the little we know is, for the most part, through the observations of the Missionaries, the Revs. J. Powell, J. B. Stair, and S. J. Whitmee.

Dr. Armstrong in his list gives sixty-three species as occurring in the group, thirty-seven of which are resident in the different islands, while six are migrants and the remainder sea birds widely distributed through Polynesia. Of these thirty-seven, twenty-one are peculiar to the Samoa Islands and indeed some are confined to one island only.

The discovery of the Tooth-billed Pigeon *Didunculus strigirostris* in 1845 created quite a stir at the time, since, at first, it was considered to have close affinity to the extinct Dodo. In regard to its habits too, there has been a diversity of opinions and Dr. Armstrong's notes on the subject are therefore of much value. He describes its movements on the ground as a waddling walk and when disturbed the flight is low and not continued far. We are glad to learn that little change has taken place in the fauna since the islands were discovered and the only bird to become extinct is the Pacific Water-hen *Pareudiastes pacificus* an example of which has not been seen for the last twenty years.

This book is perhaps rather more than a Hand-List since the author gives descriptions and notes on the habits of each species, and considering that he is now resident in New Zealand, far from a good ornithological library, it is a creditable piece of work.

N. B. K.

II. HAND-LIST OF THE BIRDS OF EASTERN CHINA. By J. D. D. La Touche. (Vol. ii, parts i & ii.) Taylor and Francis, London: 1932.

We now come in the first part of volume II to the non-passerine birds and beginning with the woodpeckers, the Coraciiformes, as far as the swifts are treated. In all some fifty-seven species are given as occurring in Eastern China, but in addition descriptions of other races found in China, but outside the limits of the work, which adds greatly to the usefulness of the book. The author has been at great pains to collect all the available information published on Eastern Chinese birds and there appears to be little he has overlooked.

One new subspecies is described—*Yungipicus scintilliceps kurodae* from Fokien—a woodpecker allied to the Pigmy Woodpeckers of India.

In the second part, two Nightjars, twenty-two Owls and forty-four Birds of Prey are dealt with. It is strange that no form of the Barn Owl, so widely distributed in different parts of the Old and New Worlds, occurs in China.

There is an interesting photograph of Chinese falconers with eagles but unfortunately the author found no opportunity of seeing the birds at work. The Golden Eagle is captured in North China both for use in falconry and for the sake of its plumage—the tail feathers are in demand for fan making. Numbers of these tail feathers were formerly imported into this country but for what purpose we do not know.

This part is well up to the standard of the previous ones and we look forward to the completion of this useful work.

N. B. K.

III. THE RIDDLE OF MIGRATION. By William Rowan. Pp. xiv and 151. 11 Text-figures. Baltimore: The Williams & Wilkins Company. 1931. (Agents: Balliere Tindall & Cox, London). Price, 11*s*. 6*d*. net.

Thanks to the wide interest which the study of Bird Migration has aroused amongst naturalists in recent years and to the many excellent contributions to the subject that have made, and still continue to make their appearance from time to time, a vast amount of data has accumulated concerning the facts and factors relating to this absorbing natural phenomenon. Careful and systematic field observations in many parts of the globe by competent ornithologists have helped increasingly to acquaint us with the *facts* of migration. Speculations based upon the observed facts were abundant enough, but it had long become evident that to arrive at anything like a true interpretation of them it was essential that the information gathered side by side in the laboratory by trained biologists—facts of structure, function, biochemistry, biophysics and so on—should be co-ordinated with the field observations.

This little book, which is by far the most original and suggestive of any on the subject that have come to our notice within recent years, examines the question of the periodic movements of birds from the standpoint of the biologist, and deals in particular with certain aspects of the possible mechanism of migration which the author is specially qualified to handle. It is at the same time an eloquent plea for the importance of the laboratory and the microscope in the elucidation of the problems of migration, as also of other problems concerning the true nature of animal behaviour. The author, in order that his work may enjoy a wider understanding than from specialists alone, rightly begins with the living bird; he points out the general principles of the avian constitution, and shows that it is futile to try and account for the inherited racial custom of migration by attributing to the bird (as has frequently been done in the past), human powers of thought and reasoning when the comparatively lowly structure of its brain clearly precludes such a possibility. He suggests that the ductless glands of the body—the endocrine system—perhaps play a much larger part in controlling behaviour than has hitherto been suspected. Indeed his experiments (to be described later) on the gonads of captive migrants controlled by artificial means, clearly demonstrate that these glands at least exercise considerable influence over the migratory mechanism. Environment is next discussed with its bearing on the evolution of migration. Several factors hitherto held to be of a more or less controlling nature (i.e. as providing the stimulus for migration), are then scrutinised and disposed of. Thus:—

1. *Failure of food supply owing to adverse wintry conditions*: Not tenable since many species already leave for the south in July before such conditions have manifested themselves.

2. *Temperature*: Similarly ruled out.

3. *Barometric pressure*: While this may speed migration it cannot be a fundamental stimulus, since low and high pressures when unseasonable, i.e. between June and August, as often happens, fail to instigate migration.

4. *Change of colour of leaves in Autumn*: Since experiments have shown birds to be dull in colour perception, this can hardly be considered important.

5. *Ultra-violet radiation*: Experiments have shown that these rays, present in sunlight, have the power to produce the substance known as Vitamin D in the avian constitution by acting on the chemical compound ergosterol contained in the preen gland possessed by the large majority of birds. The intensity of these rays varies with the angle of the sun at different seasons and is at its lowest in winter. Although they are essential for the welfare of the organism we are not justified in assuming that they are effective stimuli for migration since it is doubtful if birds can appreciate seasonal variation with sufficient promptness or intensity.

By such a process of elimination, Prof. Rowan arrives at the conclusion that Day-length is the most constant and unchanging factor of the environment (has been so throughout the ages), and that its dependability suggests this as the inaugurating principle. Experiments on the roosting, waking and singing periods of many species of birds have demonstrated remarkable sensitivity to the intensity of light.

As experiments of castration and ovariectomy both in mammals and birds have shown, the reproductive hormones can evoke particular modes of instinctive behaviour. Migration involves reproduction and must therefore be considered but a phase of sexual- behaviour. Having isolated the most constant and plausible factor in the environment, i.e. Day-length, Prof. Rowan proceeds to discover whether a gonadal hormone, elaborated at a specific season—the time of migration—might not provide the stipulated physiological stimulus. It is noteworthy that in the Northern Hemisphere the northward journey coincides with the enlargement and the southward with the diminution of the sexual organs. He works on the assumption that Day-length is the factor that controls the developmental condition of the gonads. He argues that these noticeable anatomical changes might well be accompanied by physiological, and further assumes that the hormone which provides the physiological stimulus to migration is elaborated when the gonads are in a particular phase of their cycle i.e. either increasing or decreasing.

To investigate this hypothesis he devises a series of experiments on Juncos (*Junco hymenalis*)—an American finch-like migratory bird. The experiments commence in November when the majority of juncos in the natural state have already left for their southern winter quarters. Their gonads at the time show the minimum development. By means of electric lights the shortening winter day-length is artificially increased in an experimental aviary by about 5 minutes daily, corresponding to the Spring increase experienced by juncos returning north to their breeding area in Southern and Central Alberta. Later, from December 3 onwards, the interval of extra day-light is reduced to approximate natural spring conditions as far as illumination is concerned. The aviaries, both experimental and control, are not artificially heated but are subjected to the natural temperature which is well below zero, mostly between -23° and -44°F. This incidentally demonstrates the resistance of birds to cold and disproves the generally accepted view that the Spring recrudescence of the gonads is attributable to rising temperatures. By January 9 it is ascertained by dissection that the gonads of the experimentals, which have been growing under the conditions created, have attained the spring maximum. The increase is particularly rapid towards the latter end, the same as is the case with juncos in Spring. During the last 7 days of most rapid growth the temperature ranges between -4° and -44° F. On the other hand, the gonads of the controls not subjected to artificial lighting, but given the same food and exposed to the same natural temperatures, continue to diminish until they reach the winter minimum in November where they remain till February. The experiment is reversed. The experimentals whose gonads have been artificially enlarged, instead of being subjected to the now naturally increasing day-length of Spring, are exposed to conditions where the day-length is progressively cut down at approximately the rate it decreases in Autumn. By February 13 the organs have dwindled down to the winter minimum. The experimentals are now turned out into another aviary under natural conditions of Spring with the day-light increasing by 4 minutes daily. By May 30 their gonads have again enlarged to full breeding size. These experiments prove beyond a doubt that the day-length has a direct influence on the developmental condition of the gonads.

Not satisfied with this however, Prof. Rowan proceeds to ascertain the precise factor in the day-length responsible for bringing about this condition in the gonads. In the above case the possible effects of Ultra-violet radiation are precluded since ordinary electric light bulbs (which were employed in the experiments) do not emit these rays. By means of a clever device in another experimental cage the birds are subjected to compulsory exercise so as to prevent their remaining inactive on their perches for over 20 seconds at a time. Both the experimentals and the controls (without the exercising mechanism) are placed in the same room day-length is manipulated by the opening and shutting of the windows. Both cages therefore are exposed to identical lighting conditions. At the end of the experimental day, when the windows are shut, the controls promptly retire to rest while the experimentals are restrained from doing so by the exercising mechanism which keeps them on the move. This mechanism is operated for progressively increasing periods of 7½ minutes daily. Under these conditions it is found that the gonads of the experimentals develop at the same rate as those of birds given similar periods of extended illumination outside, while the gonads of the controls remain stationary. It thus emerges that the length of time spent in activity rather than the amount of exercise obtained is the crucia factor controlling the gonads. *Activity* therefore is the missing link in the chain that connects gonad changes with variations in day-length.

Dissection and microscopic examination of the gonads show that the interstitial cells (large glandular-looking cells scattered at certain times of the year through the connective tissues separating the seminiferous tubules within the testis, and the germinal epithelium within the ovary, and not directly concerned with reproduction) are present at their maximum just when the organs are in the phase found in birds at the height of their migrations both ways. To test the hypothesis that the stimulus to the migratory impulse is provided by the interstitial or hormone-producing cells, experiments on a fairly large scale were conducted by liberating juncos and crows whose gonads had been artificially developed as described. In four successive Winters it was found that on the whole although the birds were released considerably north of their winter quarters, they showed no inclination to go south to escape the rigours of winter, but on the contrary some of them actually moved north.

The experiments of Prof. Rowan immediately open up a new and extensive field for investigation into the mysteries which have shrouded the fundamental causes and mechanisms of the great riddle of migration (and incidentally the nature of animal behaviour) baffled mankind through the ages. We recommend this book to all who take an interest in living nature and in modern methods of scientific work, and hope that the author will continue to share with us the benefits of his further researches and discoveries.

S. A. A.

IV. SIZE AND FORM IN PLANTS (With Special Reference to the Primary Conducting Tracts). By F. O. Bower, F.R.S., SC.D., LL.D. (Pp. xi—232. Illustrated. London: Macmillan & Co., Ltd. 1930.) 12*s*. 6*d*. net.

In this book Professor Bower brings together the results of his studies on a subject to which he has devoted considerable attention for a number of years.

As the sub-title indicates, the author has particularly drawn upon facts for discussion from the condition of the Primary Xylem, supplemented by his observations on other limiting surfaces also. The reason for selecting the primary conducting tracts is clearly the ease with which measurements can be conveniently made both in the living and the fossil material.

The subject so vast as that of Size and Form in Plants obviously could not be treated comprehensively within the limits of a single volume. The treatment has, therefore, been primarily confined to the limited field of the Pteridophyta. This group has been chosen not so much only because Professor Bower has made a particularly deep study of it, but also because here the conducting tracts appear in their simplest condition, i.e., uncomplicated by the developments of secondary growth, as is the case in some of the highest plants. The problem can thus be studied in its simple bearings and the facts assessed at their proper worth. Nevertheless, the author does not confine his discussions exclusively to those plants, or, for the matter of that, to any particular section of the vegetable kingdom. Consistently with the prescribed limits the evidence from the Algae, the Bryophyta and the Spermaphyta,—and even the animals—is equally well examined in the light of the facts supplied by the Pteridophyta, and is shown to support the conclusions based on their study.

The facts presented in the text are shown to conform to Galileo's 'Principle of Similarity', which the author regrets has not, in spite of its wide applicability hitherto been used in the case of plants. It is well-known, for example, that as size increases, the surface increases only as the square while the volume as the cube of the linear dimensions. Therefore on any increase in size there results an increasing disparity in the relation of the surface to volume, leading thereby to decreased ratio and to increased physiological inefficiency, when organisms, whose existence depends on the transit of materials through surfaces of various descriptions, are growing. In the case of the unicellular forms this menace is levelled up at each division of the cell, which more or less restores the original ratio. In the higher types with progressively differentiated multicellular bodies, on the other hand, the position becomes more and more complicated as growth proceeds. In plants particularly, accumulators of energy as they are, and with their distinctive organisation not only allowing but favouring unlimited growth and expansion, the working out of the principle ushers in special difficulties, and requires for the efficient discharge of functions, special, external as well as internal readjustments. In this connection the author recalls that the stele, specially in the more primitive vascular plants, has been known to undergo changes of organisation as growth proceeds, which, although they compelled attention due to the peculiarities they developed, were yet treated from a purely morphological standpoint without any attempt to interpret them in the light of the functions which they were called upon to discharge. They thus lacked the living, vital outlook and were regarded for a long time as purely formal vagaries.

Professor Bower brings to bear upon the facts, culled from many sources, the authority of his intensive studies and mature thought. By means of an instructive series of diagrams, *drawn to same scale*, he shows how, during the ontogeny of the individual, as well as in the various groups of ferns, fern-allies and the seed plants, the increasing size introduces complexities in the stele which result in effectively checking the progressive discrepancy in question. He shows how the solid core of the primary conducting strand, during the adventures of the stele, becomes medullated, fluted, corrugated and stellated, and finally broken into many separate strands in response to the necessity of maintaining, as the size increases, an effective surface in contact with the living cells. Material from all groups of vascular plants beginning with the Psilophytales has been chosen. And the author convincingly argues how those plants, such as Lepidodendroids, the Botryopterideæ and large Fern-types, e.g., Thamnopteris, which were not able to modify their stellar structure in response to the growing size, became a sort of contradiction in terms and died out. In the present day flora, too, he shows that no large plant is known to exist with a similar ineffective structure.

Besides these observations confined to the primary vascular tracts the author also examines in the sequel the changes undergone by the other two limiting surfaces, viz., the endodermis and the external surface. Further he also shows how branching, with its inevitable accompaniment of leaf-development, is a similar reaction of Form to the requirements of increasing Size, and acts as a set off against the contingent loss of proportion of surface to bulk, during development. In this way are brought together, under the influence of one dominating force, designated by the name of Size Factor (for the present left undefined), all the multifarious types of form, external as well as internal, that characterise the entire vegetable kingdom.

The presentation of the subject in the masterly manner which characterised the other writings of the author, is both refreshing and stimulating. It offers, for the first time, a rational explanation, in terms of the growing size, of the various types of stellar structures found in the plant kingdom, whose evolutionary sequence, though more or less clearly recognised, was nevertheless confined to purely morphological considerations. The treatment embodies a happy synthesis of the morphological and the physiological aspects, and gives a direct lie to the growing tendency of some to segregate morphology and physiology into water-tight compartments. The author has by his unique interpretation, the outcome of prolonged study and deep thought, has put life into what are often regarded as dry bones of Plant Morphology, whose form and evolution did not conform to any plan or law. In these studies he has struck out several new paths and freed many a problem, of great pith and moment, from the obscurity into which it had fallen or was threatened to be relegated; and restored it to its position of proper recognition. The line of treatment so successfully adopted here by the author shows how incumbent it is to revise and overhaul the present system of botanical teachings, in order to bring it up in a line with the modern developments, and give to it its fuller interpretation.

N. K. T.

V. POCKET-LENS PLANT LORE. By James Small, D.SC., F.L.S. (Pp. 224. Illustrated. London: J. & A. Churchill. 1931.) Price 5*s*.

This little book, the author informs us, owes its birth to the inquisitiveness of two small children—Sheila and Donn—'who wanted to see the insides of things', and it is the hope of the author that 'it may be useful and interesting to youthful inquirers of all ages.'

The text is written in the simplest language and, of course, without the use of technical terms and of long words. The material has been arranged month by month, and the directions are straightforward and clear. They deal with the comparatively more obvious and more easily determinable features of the specimens. There are full-page illustrations accompanying the text.

All that is required in the shape of equipment are a pocket lens magnifying about 10 diameters, a pair of tweezers, a sharp pocket knife (or a small razor) and a piece of stiff celluloid.

There is no doubt that the book will prove useful and stimulating to all who may be interested in the 'insides of things'. As the writer himself points out 'a vastly interesting region lies between the high magnification of the ordinary microscope, . . . and the usual range of details which can be seen with the naked eye,' and it might therefore appear strange that before the present author no one seriously thought of bringing it within the practical range of all and sundry. This little book will no doubt fill up this gap and will further stimulate interest by unfolding the beauties of nature that ordinarily lie beyond the range of the ordinary human vision. Although written primarily for the British readers yet it can be easily adapted to conditions elsewhere too by substituting suitable types. One only hopes that the illustrations were bigger even though in this they went beyond the original magnification of the lens itself.

N. K. T.

MISCELLANEOUS NOTES

I.—THE BALINESE TIGER.

PANTHERA TIGRIS BALICA (SCHWARZ).

A considerable amount of literature has appeared on this supposed form, but apparently, (from lack of material) none of the authors felt quite sure as to its real validity as a separate subspecies.

Schwarz, in his original paper,[1] described the form from a single flat skin and skull, chiefly on the ground of the smaller size and flatter bullae, as compared with the Javanese-Sumatran races. Afterwards[2] he published a photograph of the same skull.

Then we find[3] a quotation on the animal, taken from a letter, written by Mr. B. Ledeboer (now dead, killed in Africa by an elephant) to Mr. Jacobson at Fort de Kock, Sumatra, translated and published by the latter. Rightly, the information given in this letter, is called 'puzzling' by Pocock.[4] Amongst other data we read there that the Balinese tiger is *not* smaller than the Javanese, and above all that, 'if a Sumatran tiger is laid on its back, nothing is seen but a whitish skin, the underside of head, throat, breast and belly being totally without markings!' Here there must be considerable misunderstanding, though I cannot make out who the offender is—either Mr. Ledeboer has made a very thoughtless error, or Mr. Jacobson has mis-translated his letter in English? Mr. A. Ledeboer (brother of Mr. B. Ledeboer), whom I visited for this purpose, told me and, moreover, clearly demonstrated from his collection of skins, that there is indeed no question at all about the Sumatran tiger being striped on the belly—the stripes of the back *certainly* invade the underparts, and therefore such a supposition has never occurred to him or to his deceased brother! As concerns the smaller size of the Balinese Tiger, in this respect also the remarks in the letter of Mr. B. Ledeboer are quite unexplainable. Indeed, Mr. B. Ledeboer previously published another letter[5] in which he (knowing nothing of Mr. Schwarz's new description) gave his observation on the smaller size of the Balinese tiger! which his brother Mr. A. Ledeboer at once confirmed. I hope that I have now removed any misconception that may have arisen from the really very puzzling information in the letter of Mr. B. Ledeboer.

Again, during my short visit to Mr. A. Ledeboer, I had the opportunity of looking over his large collection of skins and skulls of the Sunda-tigers (Sumatra, Java, Bali). Mr. A. Ledeboer had just obtained his 100th tiger, while the material of Mr. B. Ledeboer was also available! Unfortunately, my very limited time (only one afternoon), and further, the fact that the whole collection (skins and skulls) was decorating the walls of the house by way of 'hunting-trophies', prevented me from making a thorough study of this splendid material. Nevertheless, aided by Mr. A. Ledeboer's knowledge—I here publish a few data on his material—even a cursory examination showed that the differences between the 3 Sunda-races of the tiger were so obvious, that, indeed, a single glance was sufficient to distinguish the races and to recognise the origin of the skins and skulls from their appearance!

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[1] *Ann. Mag. Nat. Hist.*, 8-x, 1912, p. 325.

[2] 44 *Ber. Senckenb. Naturf. Ges.*, I, 1913, fig. 3.

[3] *Journ. F.M.S. Mus.*, x, 1921, p. 237.

[4] *Journ. Bom. N.H. Soc.*, xxxiii, 1928, p. 534.

[5] In Koningsberger, *Java Zool. Biol.*, *Buitenzorg*, 1915, p. 422.

Without claiming even approximate completeness, I enumerate the following differences:

	sumatrae	*sondaica*	*balica*
Size	'normal'	'normal'	smaller
Ground colour of the skin	lightest	darker	darkest
Colour of innerside of forelegs	whitish	a lighter shade of the general groundcolour	like in *sondaica*
Nasals	short and wide	long and narrow	long and narrow
Occipital plane	broad	narrow	narrow
Frontal line (forehead)	most flat	more vaulted	still more vaulted
Bullae	'normal'	'normal'	somewhat flatter

Of course I very much regret not having had the opportunity to trace all the differences in detail, and especially not to be able to fix any point in exact numbers. But, in connection with the doubt expressed by Kloss[1] and Pocock (l.c.) about the validity of Schwarz's form *balica* (and even Mr. Schwarz himself wrote me that he should be glad to hear of a further confirmation of his race), I think that even these incomplete (but, as far as they go, quite sure) data are of sufficient importance. For myself they have removed the last doubt as to the validity of the 3 named races of tigers of the Sunda Islands.

H. J. V. SODY.

[We append below a note by Mr. R. I. Pocock.

'Knowing my interest in Tigers, the Editors kindly sent me the MS. of Mr. Sody's paper on the races of the Sunda Islands before setting it up in type.

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[1] *Journ. F.M.S. Mus.*, x, 1921, p. 237.

When writing on these Tigers in 1928, I had very few specimens whereon to form completely satisfactory conclusions regarding the distinctness of the Tigers of Sumatra and Bali from those of Java described many years ago as *sondaica*. Hence the additional evidence on these points now supplied by Mr. Sody is particularly valuable and interesting. It is to be hoped that he may get further opportunities of extending his observations. His disapproval of the 'puzzling' statement, attributed to the late Mr. B. Ledeboer, regarding the alleged absence of stripes on the lower side of the Sumatran Tiger (*sumatrae*) is also very gratifying'.—Eds.]

II.—REMARKABLE BEHAVIOUR OF A TIGRESS.

While on the survey of the Eastern Ghats I was told a very strange tale (not by Col. Longbow) of the behaviour of a tigress in the Nallamalli Hills. As a matter of fact the story has gone its 'umteenth' round among the Officers and Rangers of the Forest Department in the Cuddapah and Kurnool districts.

The scene was in the Nallamalli Hills, at Iskakundam Bungalow, which is about 30 miles from Diguvametta. The Conservator and his Deputy had occupied the two rooms in the forest bungalow, the rest of the staff were in the out-houses.

The Deputy was writing his report under a petrol lamp in his room when he felt something brush against his chair. He slightly turned his head and saw a tiger rubbing itself along the back of the chair! !

I wonder what a good many of us would have done? Shouted? Screamed? Jumped on the table? or fallen down in a dead faint? The Deputy did none of these things. He was not a big game hunter. I doubt if he had ever killed a thing in his life. He calmly got up from his chair and as calmly walked out of the room—closing the door behind him.

As calmly he announced to the Conservator in the next room, that he had securely locked a tiger in his room.

None of us can blame the Conservator for jumping to a quite natural, though in this instance, unwarranted conclusion. The Deputy never drank a drop of spirits in his life.

They both went outside and peeping through the barred window saw the tigress placidly rubbing herself against the table. The first shot hit the animal but in leaping up she upset the lamp which fortunately was extinguished by the fall. The second shot was fired from the roof, through a hole in the thatch.

On examining the animal it was found that she suffered from a wound on the thigh which was alive with maggots.

Now here is something for our big-game hunters to solve. Though we cannot possibly afford a prize for the best explanation put forth, it will give us an insight into the philosophy with which each big-game hunter and others approach the fascinating study of animal behaviour. What brought the tigress into the bungalow?

BOMBAY. V. S. LA PERSONNE, M.B.O.U.,
March 31, 1932. *Asst. Curator.*

III.—THE SKIN OF A PERSIAN PANTHER (*PANTHERA PARDUS SAXICOLOR*).

I am indebted to Mr. S. H. Prater for kindly sending to me for examination the skin of another Panther shot by Mr. A. A. K. Sangster. The animal was killed 'just across the Afghan border about 17 miles north of Zambaza', where the first was procured. The skin is unfortunately undated but appears to be in summer coat. The hairs at all events are much shorter and the rosettes in consequence better defined. The colour too is not so pale, being greyish buff with the dorsal area and the centres of the rosettes a shade darker, the difference no doubt being seasonal. It is a shade more buffy than the skin from Seistan, presented to the British Museum by Col. R. L. Kennion and rather paler than the one from the Perso-Baluchi border collected by Capt. J. E. B. Hotson. These skins were referred to on pp. 79 and 82 of my paper on Asiatic Panthers published in Vol. xxxiv, p. 64 of this *Journal* in March 1930. I may add that the four skins here referred to no doubt belong to the same race of Panther, namely the so-called Persian Panther (*P. p. saxicolor*). They are strikingly different from the only known skin of the Panther from the Kirthar range, Sind, which I described as *P. p. sindica*. The coat of this is harsh and short but quite thick and woolly and the dorsal area and the centres of the rosettes are comparatively rich ochreous. Additional skins, with skulls, of this Sind Panther are much needed.

May 12, 1932. R. I. POCOCK, F.R.S.

IV.—BLACK LEOPARDS.

The following experience with black leopards may be of interest to readers of the Journal.

On the 5th. November 1931 some local Assamese came to me with the body of a fine female black leopard which they had caught in a trap, the animal had been dead some few hours and had obviously died from maltreatment. I told them if by any chance they ever caught another to let me know at once; this they promised to do, and departed. At dawn next day they were back again to tell me that another, and larger, black leopard had just been caught in the same trap. I immediately went to the spot some 15 miles away, and there sure enough was a fine male animal; with some difficulty I got it hog-tied and muzzled and carried to my car, in which I brought it back. Meanwhile an unused godown had been prepared for its reception. The difficulty then arose as to how we were to free the animal from its bonds once it was in the godown. Eventually we decided to chloroform it, and with the help of my friend we accomplished this by covering its head with an oiled silk topee-cover in which was a pad of cotton wool soaked in chloroform. In a very short time the animal was apparently nicely off, and we, in our inexperience, thought we had administered sufficient anæsthetic and proceeded to drag it into the godown and cut it loose. We had just accomplished this and I had barely slipped the muzzle off when the animal staggered to its feet. We made a rush to get out of the godown, which we did with the leopard hot on our heels. My friend turned round and caught the still slightly dazed animal a kick under the jaw and tried to pull the door too but there was no stopping it; it was now loose in my compound with the hitherto interested audience of over a 100 coolies flying in all directions. My friend had by this time snatched up a bamboo and dealt the leopard a blow on the head, this, instead of having the desired effect seemed to wake up the animal! I thought it was high time I took a hand in the proceedings, which I did with the aid of a ·450 automatic pistol.

I now had two specimens of black leopard. Three days after to my surprise, the same Assamese came with the tale of having caught a third black leopard, this seemed altogether too surprising but was nevertheless true. This time I made a better 'bundobast' and a fine male black leopard is now reposing in a more or less leopard proof godown and will shortly be transferred to the Calcutta Zoo.

I understand that the black leopard is usually regarded as a 'sport' which occasionally occurs in a litter of ordinary cubs; but the apparent numbers of this type of leopard, one was caught two years ago by the same people in the same spot, rather points to the fact that they prefer to mate with each other and produce a litter of black cubs.

The three leopards all had a similarity of appearance, a markedly long and thick tail, eyes of a curious pale-blue. The people assure me that there is still another at large, and are arranging to build a *machan* to enable me to sit up and get a shot at it.

Would you regard the black leopard as rare in this part of India—I should be interested to receive any information as regards these animals.

NYA GOGRA T.E.,
GOHPUR P.O.,
DANANG, ASSAM.
August 3, 1932.

R. M. PIZEY.

[Black Panthers are not a distinct species as is believed by many. The phase of colouration known as melanism is the opposite of albinism. The former is due to the excessive presence of black pigment known as melanin which darkens the colour of the hairs, while albinism is a condition in which the black pigment is entirely, or partially wanting. Black Panthers are particularly plentiful in regions of heavy rainfall and great humidity. They are very common in Java and the Malay countries, and have been recorded from Burma, Assam, Nepal and in the forests of Travancore and South-Western India. Similarly albinism appears to be more frequent in the drier regions of India. In Volume I, page 71 of this *Journal* Mr. Newnham draws attention to the frequency of albinism observed among animals and birds in Cutch. It has also been observed that creatures which live in colonies and are liable to *inbreeding* and those which from breeding often have become over abundant, are also subject to albinism. Albinism is thus frequent among domestic animals and birds or wild species, like the peacock, bred in confinement under unnatural conditions and without the stimuli of natural enemies. Albinism may arise as a germinal variation, i.e. a hereditary factor which influences the normal functioning of pigment-forming substances has dropped out of the inheritance, and true albinos so effected will on interbreeding continue to produce albino offspring. Similarly in melanism, the darkening of the hairs, or the plumage, or scales may of course be individual modifications, but there are cases, as with the black panther, where melanism is exhibited in a large section of the species in a given area and here we probably have to do with germinal variation and interbreeding among these black panthers results in the perpetuation of the melanistic form.—Eds.]

V.—A CARNIVOROUS BEAR.

We went from Srinagar to Pahlgam for a few days' outing and sport. Pahlgam is a lovely spot in Kashmir, about 63 miles from Srinagar. The main pathway of the ancient pilgrimage to Amarnath begins from there.

It was here, on the 1st. of July, that I made my first acquaintance with the Himalayan Black Bear (*Ursus torquatus*)—under somewhat strange circumstances, which have led me to write this account. The local shikari brought in news of a bear having killed a calf; and he assured us that the beast would come back to feed on the carcase before sunset. This report we did not credit at first, because the bear is generally known to be herbivorous. Therefore I decided to investigate their report personally, as never have I known, or heard, before of an animal being attacked and killed by a bear for food. However, on visiting the spot, I found the carcase of a calf which had been killed a couple of days previously; and about half of it had been eaten already. So I decided to sit up. A fine, big bear came at about 7 p.m. and was shot; but what interested me was that the animal came to the kill just as carnivora would do. I talked about this experience of mine with the Game Warden of this State, who told me that he had heard from natives about these Himalayan black bear occasionally doing some damage among the natives' live stock; but this was the first time he had had reliable first-hand information of a bear returning to a kill.

Srinagar. MADANSINH OF KUTCH.
July 11, 1932.

[The food of the Himalayan Black Bear (*Selenarctos thibetanus*) consists mainly of roots and fruits in quest of which this bear is frequently found in fields and orchards. Like most bears it is fond of honey and raids beehives. It has been known to feed on swarming locusts. At the same time the Himalayan Black Bear is the most carnivorous of Indian Bears. Not only does it kill cows, sheep, goats and deer but it also feeds on carrion. In a note on the habits of these Bears (*Journ. B.N.H.S.*, vol. xvii, p. 833) Mr. C. H. Donald comments on this bear's clumsy methods of killing. He came upon a bear making a kill—the victim was a cow. He shot the bear and put the cow out of its misery. The animal had one leg broken, two huge pieces of flesh taken out of her flanks while her stomach and hind quarters had been horribly lacerated by the bear's teeth and claws. Of 11 fresh kills made by bears and seen by him—one of them, a bullock, was dragged up and placed in the fork of a tree!—Mr. Donald states that except in the case of a fine big buffalo, which was mauled about the neck and shoulders, all the victims were done to death in the same crude manner. It is evident that this bear, from the horrible job he makes of it, is a prentice hand at killing animals. The Brown Bear (*Ursus arctos isabellinus*) may develop carnivorous habits in the absence of its regular food. This consists mainly of herbs, fruits and roots. This bear restricts its depradations to goats and sheep which it kills with one blow of its powerful paw. The Brown Bear does not attack cattle but has no hesitation in making a meal of a dead cow or buffalo. The Indian Sloth Bear feeds mainly on fruits and insects—but will occasionally feed on dead animals. Mr. Hasted records an instance of one which made a meal of a snake, which the writer took to be a Russell's Viper.—Eds.]

VI.—WILD DOGS KILLING BY NIGHT.

I send you herewith an account of Wild Dog killing at night, which you may care to publish as being interesting.

In May this year I was shooting in the Sal forests in a reserved block about 50 miles S.-E. of Mandla. We had five *bodas* tied out for tiger kills, the nearest one to the bungalow being just over half a mile away on the forest road and where a fire-line and a track joined it, and 300 yards beyond a bridge over a small nullah which still had a few pools of water remaining.

We were sitting at dinner at 9 p.m., pitch dark, no moon, when we heard bellowings from this *boda* and at once imagined it was a tiger killing it. The noise from the buffalo however continued so long that we were puzzled, and calling one of the shikaris, we asked him what it meant; he at once said 'Wild Dog' which I queried, pointing out that it was too late and dark for wild dog to be out hunting. At daylight next morning the *boda* coolie came back at once saying there were about 30 Wild Dogs with puppies on the kill in the nullah. We went down at once but the dogs had all gone, and we found the remains of the *boda* (practically all eaten) close to a pool in the nullah. There was a clean drag from where the *boda* had been tied down to the nullah, a distance of about 200 yards and nothing but dog tracks visible in the vicinity. I searched all the roads and nullah but could find no sign of tiger or panther tracks.

I fancy the pack were coming down the road on their way home later than usual and finding the *boda*, killed it; but why this long drag? I have never known them to drag their kills before. Was it anything to do with the puppies in the water?

R. A. MESS, T. H. CARLISLE,
JUBBULPORE, C.P. LT.-COL., R.A.
June 20, 1932.

VII.—WILD DOGS HUNTING AND KILLING BY NIGHT.

Apropos of Ramanuj of Surguja's note on 'Wild Dogs Hunting at Night,' I have on record six instances of Wild Dogs hunting and killing their quarry by night. Four instances are from the plains and two from the Himalayas; in four of these cases I have heard the Wild Dogs in full cry.

The first instance, and the most prolonged hunt, was that of a Sambar hind, which appeared to elude its tormentors for half the night.

I had frequently seen the hind while pottering about for birds. She was heavy with young. One night (there was no moon), at about 11 p.m., we heard the Wild Dogs barking and yelping. The sound came from many directions as the Forest Bungalow at Ballepalle (Eastern Ghats) was perched on a knoll we could easily follow the gruesome chase as it circled around us. At 4 a.m. there was silence and taking the rifle I set out to investigate. A half mile into the forest and I could hear snarlings and yaps of pain as the Wild Dogs fought each other over the kill. I shall never forget the awful sight which greeted me when turning in the direction of these sounds I found my hind with her head thrust into a thick bush and the most agonising look in her glassy eyes. Her hind quarters were eaten away, and the protruding hind legs of the unborn Sambar eaten up to the knees.

Case No. 2 was that of a male Sambar in the Palkonda Hills of the Eastern Ghats. The 'baying' began at about 9 p.m. (no moon), but the quarry was in no mood for a long run, and evaded death by taking refuge in the bungalow stables! We flashed the light on him and saw a nasty gash on his left flank. It must have been touch and go for that Sambar. He limped out at the first sign of dawn but flashed into the forest on hearing our rousing cheer.

Case No. 3 was that of a Cheetal in the Nallamalai Range (Eastern Ghats). The 'baying' began at 10 p.m. and by midnight the sounds stopped. It was not a full moon night, of that I am certain. Next morning we set out to find the kill. There were portions of the head and larger bones scattered about, nothing else!

Case No. 4 was of another Cheetal but this was killed before 9 p.m. It was a dark night.

The two cases from the Himalayas occurred at Lachung in Sikkim at 10,000 feet. Both kills were made at night which are usually misty during the months of June and July. But both these kills were cattle and I do not think they come under the category of a 'hunt'.

What particularly struck me in the Wild Dog hunts was the understanding of team work each Dog seemed to possess.

The case of the Sambar hind which I mentioned first gave me a very good idea as to how these dogs work. Each foot path and track bore the imprints of their pads, always leading towards a common centre. The Dogs had come in singly or in pairs down every available tracks, a mile away from the common centre where we found the kill. The dogs seem to realise that a big creature like a Sambar cannot very well charge through undergrowth but must keep to the paths.

The Ramanuj of Surguja raises a point as to the keenness of sight among Wild Dogs at night. I should not think it would be absolutely essential for Wild Dogs to possess very keen night-sight to detect game in jungles frequented by game. Mostly all game stick to the paths and tracks which show up quite distinctly at night and any object moving down or across a path would be detected. Besides sound and scent play a very great part in a Wild Dog hunt.

Dense forests into which the sun never penetrates and which are as black as ink at night, never harbour any game animals. Most game keep to the open or patchy forests. Here there are more opportunities of evading capture by fleetness of foot and here also the hunters reap their harvest.

Bombay Nat. Hist. Society.
July 15, 1932.

V. S. LA PERSONNE,
Asst. Curator.

VIII.—CARCASES OF ANIMALS DYING OF RINDERPEST AVOIDED BY JACKALS AND OTHER CARNIVORA.

On reading through the *Nilgiri Game Association Reports* from 1895 to last year I see that in the Report of 1909 an outbreak of rinderpest among bison and sambhur is reported (imported by cattle), and it was observed that the carcases of animals found dead from rinderpest were not touched by jackals.

During the severe outbreaks of rinderpest in the past three years among cattle in the Kollegal Division it was noteworthy that although the flesh of the animals that died from this disease was removed and eaten by the low caste people, neither tiger, panther, nor jackal would touch the carcases; I cannot vouch for the hyaena.

That the disease spread so rapidly was due, I think, to the meat being carried by the low caste Madigars from village to village.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE, S.I.
April 19, 1932.

RANDOLPH C. MORRIS.

IX.—DEATH OF AN ELEPHANT FROM RABIES.

The following case of the death of a tame elephant by rabies may be of interest.

On the 16th. of January of this year, one of my cow elephants was bitten on the trunk and round the hind quarters by a dog. The wounds were immediately cauterized, and on 24-1-1932 though the dog had not been recovered and identified as mad, a course of anti-rabic treatment was commenced. Fourteen injections of vaccine at the rate of one per day were given, until 6-2-32. The wounds healed up properly, and until 26-2-32 the animal was in normal health, eating its rice and fodder as usual. On 27-2-32 the elephant went lame in the off hind leg. On 28-2-32 paresis set in, and the animal fell down on her stifle joints and, though in much pain, she made attempts to get up again. She ate a little fodder and drank water. This condition continued on 29-2-32, but on 1-3-32 it became aggravated, and she was only able to recline on her elbow and stifle joint. Her appetite was poor, and a few wisps of green grass was all she could manage to eat. On 2 and 3-3-32, the paresis developed into paraplegia with absolute loss of the use of the hind quarters.

On 4-3-32, swelling of the tail and hind quarters was apparent, with a total loss of appetite and failing consciousness.

On 5-3-32 total paralysis set in, with loss of consciousness, rapid, irregular and feeble pulse, laboured breathing, cold and hide bound body, cynosis of the mucous membranes and on 6-3-1932 the animal died.

During the period of sickness the animal grew very thin.

Microscopical examination of the brain by the Pasteur Institute revealed positive rabies.

It is noteworthy that, at no time, was there the slightest sign of the disease taking a violent turn.

VIZAGAPATAM.
April 15, 1932.

J. BECKETT,
District Superintendent of Police,
Vizagapatam.

X.—SOUNDS MADE BY GAUR OR INDIAN BISON (*BIBOS GAURUS*).

I have read many Natural History books, but in none have I seen described a curious call uttered by, I believe, only bull Gaur (*Bibos gaurus*). The other day I was watching these animals grazing in the late evening, when the call was heard in the distance and answered by one of the herd, whether a bull or not I could not ascertain, a curious bell-like note, sustained for an appreciable time and ending in what only can be described as a rasping sigh, almost a roar, the whole being a wild combination of a sambhur's bell and a tiger's roar, it may be written 'o-o-o-o-o-o-o-o-aagh', it is notoriously difficult to describe sounds in writing, but the only book I have read in which calls made by Gaur are described, Dunbar Brander's *Wild Animals of Central India*, he mentions five distinct sounds, none of which approximate anything like the sound I was so fortunate to hear.

I have been informed by Dufflas, who are, of course, familiar with sounds made by the Gayal (*Bibos frontalis*), their domestic mithun, that a similar call is made by the bulls, but not quite the volume of sound as made by *Bibos gaurus*. The above may be of interest to readers of the *Journal*.

NYA GOGRA,
GOHPUR P.O.,
ASSAM.
March 26, 1932.

R. M. PIZEY.

XI.—THE DURATION OF LIFE OF SOME INDIAN MAMMALS.

(*The Indian Forester*, vol. lviii, Feb. 1932).

The duration of life among mammals is a subject of some interest in agriculture and forestry, but practically no information on it has been hitherto available. Major Stanley S. Flower has now concluded a series of 'Contributions to our Knowledge of the Duration of Life in Vertebrate Animals' in the *Proceedings of the Zoological Society of London* with a discussion (1931, pp. 145-234) of the available information on mammals. From this splendid work, which is based on a large series of records of mammals in captivity in various parts of the world, the following information relating to Indian species has been abstracted by request. The names in brackets are those used by Blanford in his volume on mammals in the 'Fauna of British India' series.

The Gibbons, *Hylobates hoolock*, *H. lar*, etc., reach maturity when about seven years old. 'Instances of their living in captivity to nine years are rare, though they may live to the age of at least twenty-four years.'

'The Old-World Monkeys, regardless of size, appear to have an average life of under seven years, a specific longevity of about ten years, a full-span life of about fifteen years, and a potential longevity of about twenty-five to thirty years.' Langurs have lived in captivity in Calcutta for ten years, and a Nilgiri Langur survived for fifteen years in the Trivandrum Zoo.

Among the *Macacus* monkeys, the common *M. mulatta* (better known as *M. rhesus*) frequently lives to fifteen years and even more. There is a record of one individual that was probably twenty-nine years old at the time of its death. The Bonnet Monkey, *M. radiata* (*M. sinicus*) averaged a life of twelve years in the Trivandrum Zoo, and one individual lived to fifteen years. The Macaque or Kra Monkey, *M. irus* (*M. cynomolgus*) lives for fifteen years, but individuals may live for almost twice this period. *M. silenus*, the so-called Wanderoo or Lion-tailed Monkey, only lives for five to ten years in captivity as a general rule. A Slow Loris, *Nycticebus coucang*, has been recorded as living for ten years in the Calcutta Zoological Gardens.

Of the insectivores little is known. A Bornean Tree-Shrew, *Tupaia tana*, has lived in the London Zoo for a little more than two years, and Hardwicke's Hedgehog, *Erinaceus collaris*, has survived in the same place for almost two and a half years. The average life of shrews and hedgehogs is probably in the neighbourhood of two years.

The Fruit-Bats have an average life of nine years with an extreme maximum of about twenty years. The common Flying Fox, *Pteropus giganteus* (*P. medius*), does well in captivity, a female having lived in London for over seventeen years and a male in Dublin for over eight years. Among the insectivorous bats Roux's Horseshoe Bat, *Rhinolophus rouxi*, seldom lives over four years and is not known to reach an age of five years.

Tigers, *Felix tigris*, may be expected to live in captivity for four or five years, but Flower has notes of fifty individuals with an average life of eleven years. Records of extreme longevity show that tigers can live for thirteen to nineteen years and probably more. Leopards, *Felis pardus*, appear to have a very similar span of life. Of the Snow-Leopard, *Felis uncia*, little is known, but it does not appear to have done well in captivity. One male lived in the London Zoo for a little over three years, and in Philadelphia a specimen died after nearly eight years of captivity. For other species of Felidae that occur in India the following records are available:—

Jungle Cat, *F. chaus*. Three specimens known that lived for a little more than nine years.

Lynx, *F. lynx*. One record (♀) of sixteen years life, and one (♀) or nearly eleven years.

Caracal, *F. caracal*. Seldom lives over seven or eight years in captivity. Individuals have, however, survived for as long as sixteen years.

Clouded Leopard, *F. nebulosa*. Difficult to keep alive in captivity. A female has, however, lived in the London Zoo for eight years.

Leopard Cat, *F. bengalensis*. One record of twelve or thirteen years life. A female is still alive in the London Zoo after some nine years there.

Golden Cat, *F. temminckii*. One record of life in captivity for nearly eleven years.

Fishing Cat, *F. viverrina*. Two records show that the average life is in the neighbourhood of ten years.

Cheeta, *Acionyx* (=*Cynælurus*) *jubatus*. Seldom lives for more than six years in captivity. Records of extreme longevity show, however, that individuals may live for more than fifteen years.

For Indian Civets and Palm-Civets (*Viverridæ*) the following records are known:—

Indian Civet Cat, *Viverra zibetha*. Five records of nine to fifteen years (average about twelve years).

Small Indian Civet or Rasse Civet-Cat, *V. malaccensis*. Between seven and eight years (two records).

Burmese Tiger Civet, *Prionodon maculosus*. One doubtful record of a specimen having lived for more than eighteen years.

Indian Palm-Civet, *Paradoxurus niger*. More than fourteen years (one record).

Malayan Palm Civet, *P. hermaphroditus*. Nearly twelve and a half years (one record).

Paradoxurus leucomystax. About thirteen years (two records).

Paradoxurus larvatus. Two records, showing a life of nearly eleven years and fifteen and a half years respectively, are available.

Small-toothed Palm Civet, *Arctogale leucotis*. Two records showing a life of eight years and eleven years respectively are given by Flower.

Bear Cat or Binturong, *Arctictis binturong*. A specimen was still living in the Trivandrum Zoo in 1913 after nearly twelve years there. Another died in London after being in captivity for eighteen years in Singapore and London.

Among the Mongooses, the common Indian Mongoose or Grey Mongoose, *Herpestes nyula* (also known as *H. griseus* and *H. mungo*) has an average life of two years in captivity, the records for extreme longevity being nearly five years (London) and eight years (Trivandrum). Other species of Indian Mongoose do better in captivity as the following records show:—

Spotted or Small Indian Mongoose, *H. auropunctatus*. The average life is about seven years according to records from Calcutta and London.

Ruddy Mongoose, *H. smithii*. One specimen lived in the London Zoo for nearly six years.

Ceylon Brown Mongoose, *H. fulvescens*. One specimen lived in the London Zoo for nearly five and a half years.

Stripe-necked Mongoose, *H. vitticollis*. A male survived captivity in the Trivandrum Zoo for nearly thirteen years.

Of the Hyaenas, Major Flower writes:—'The Striped, the Brown and the Spotted Hyaenas are all long-lived animals. Fifty-four individuals in fourteen different collections had an average life of twelve years and maximums of from twenty-three to twenty-five years.' Eight records of the striped Hyaena, *Hyaena hyaena* (*H. striata*) range from nearly twelve years to twenty-four years, the majority being in the neighbourhood of sixteen years.

Regarding wolves, thirty specimens of *Canis lupus* averaged a life of nearly ten years, cases of extreme longevity being represented by two records of nearly fourteen years. Two Indian wolves, *C. pallipes*, are believed to have lived in captivity for nearly thirteen and fifteen years respectively. Jackals show an average and extreme length of life similar to that of wolves. Specimens have lived for over twelve years in the Trivandrum Zoo and for over fifteen years in the Calcutta Zoo.

Several English specimens of the Common Fox, *Vulpes vulpes* (*V. alopex*) have lived in the London Zoo for more than eight years. Blanford, however, states that 'Foxes live thirteen or fourteen years'. An Indian Desert Fox, *V. leucopus*, lived in the London Zoo for nearly eleven years. Of the other Canidae little is known. An Indian Wild Dog, *Cuon dukhunensis*, was still alive in the Trivandrum Zoo after nine years, and a Malay Wild Dog, *Cuon rutilans*, survived captivity in the London Zoo for six and a half years.

Records of the *Mustelidæ* are confined to Otters in so far as species occurring in India are concerned. Indian Otters have survived captivity for periods between eleven and sixteen years.

Bears live well in captivity. The average life of the Brown Bear, *Ursus arctos*, seems to be over twenty years, the extreme age not less than thirty-four years. The Himalayan Black Bear, *U. tibetanus* (*U. torquatus*), seems to have a very similar duration of life. The Malay Bear, *U. malayanus*, appears to be shorter lived, the average being under twelve and the extreme under twenty-one years. Several Sloth-Bears, *Melursus ursinus*, have lived in captivity for an average of twelve years and some for periods between sixteen and twenty-two years. According to Blanford, a Sloth-Bear may live for forty years, but this is probably an over-estimate.

Among the Rodents, rats and mice have a specific longevity of two to three years and a potential longevity of five to seven years. Flying squirrels, squirrels, marmots and porcupines appear to have a specific longevity of five to ten years and a potential longevity of fifteen to twenty years. The following information relates to Indian species:—

Large Flying Squirrel, *Petaurista* (=*Pteromys*) *inornatus*. A specimen lived in the Calcutta Zoo for over eleven years.

Palm Squirrel, *Funambulus* (=*Sciurus*) *palmarum*. An albino specimen lived in the London Zoo for five and a half years.

Giant Squirrel, *Ratufa indica*. A specimen, in the possession of the Bombay Natural History Society, lived for over sixteen years.

Hodgson's Marmot, *Marmota* (=*Arctomys*) *caudata*. Three individuals lived to over six years in the London Zoo.

Black and Brown Rats, *Rattus rattus* and *R. norwegicus*. The average life of these rats is probably two to three years, but definite information is not available.

House Mouse, *Mus musculus*. Major Flower's longest record is only a year and a half. As a schoolboy I domesticated a litter of mice; they remained alive for about a year.

Bamboo Rat, *Rhizomys badius*. A specimen lived in Calcutta for at least three years; another lived in the London Zoo for nearly three and a half years.

Porcupines (*Hystrix* spp.) and Brush-tailed Porcupines (*Atherurus* spp.) live from eight to twelve years, extreme longevity in *Hystrix* being represented by a specimen that lived to nearly twenty and a half years in the London Zoo. Hares and rabbits 'live to an age of five or six years, and exceptionally to twice as long'.

The specific and potential longevity of the Indian Elephant appears to have been greatly exaggerated by several writers including Blanford. According to Flower there is no 'absolutely convincing evidence of an Elephant living to the age of 100 years'. Of sixty elephants seen by him in India and Burma in 1913 the oldest were under fifty-five years of age, while from records of elephants outside India 'that have lived longest in their respective new homes we find that they have an average life of a little over twenty-eight years' and it is reasonable to suppose that elephants survive even better in captivity than they do in the wild state. From the evidence of dentition seventy years would appear to be a liberal estimate of the potential longevity of an Indian Elephant. It is also of interest to add that elephants become sexually mature at an earlier age than is commonly supposed. Cases are known of elephants that have calved when between thirteen and sixteen years of age.

Asiatic Wild Asses average a life (according to twenty-three records) of about fifteen and a half years and may live to twenty-two years or more. Records of Kiangs, *Equus kiang* (*E. hemionus*) show that individuals may live in captivity for periods ranging from eighteen to twenty-five years. A female Indian Wild Ass died in the London Zoo after nearly sixteen years of captivity.

Most Rhinoceroses are said to live for less than ten years in captivity, but 'twenty-seven selected individuals show an average life of almost twenty-two years', and individuals have been known that have lived for over forty years. Fifteen records of the Great Indian Rhinoceros, *Rhinoceros unicornis*, show an average life of about twenty-nine years, a minimum of fifteen and a quarter years and a maximum of forty-seven years. An individual of the smaller Sondaic Rhinoceros, *R. sondaicus*, lived in the London Zoo for nearly eleven years, and another in the Calcutta Zoo for over fourteen years. Four records for the two-horned Rhinoceros, *R. sumatrensis*, show a life between ten and thirty-five years.

The majority of Tapirs live less than six years in captivity, but their potential longevity is at least thirty years. The average for eighteen individuals over seven years of age is about fifteen years. The longest records in the London Zoo for Malay Tapirs, *Tapirus indicus*, are nine and a half years for a male and a little over eleven years for a female. A Tapir, probably the same species, lived in the Trivandrum Zoo for twenty-three years.

The larger wild cattle have a specific longevity of nine to twelve years, and a potential longevity of twenty to twenty-five years, or even (but very rarely) thirty years. The Domestic Humped Ox, *Bos indicus*, frequently lives between ten and fourteen years; a pair of gayals, *Bibos* (=*Bos*) *frontalis*, lived in London for about fifteen years; Yaks, *Poephagus* (=*Bos*) *grunniens*, are capable of breeding to at least eighteen years of age, six records of long-lived Yaks ranging from fifteen to nearly twenty-four years. A very long-lived Asiatic Buffalo, *Bubalis* (=*Bos*) *bubalis* lived in captivity for over twenty-nine years and must have been over thirty years of age when it died.

On wild sheep, goats, goat-antelopes, and antelopes the following information is available:—

Urial, *Ovis vignei.* Three individuals have lived for over eleven years in the London Zoo.

Bharal, *Pseudois nahoor* (*Ovis burrhel*). Ten individuals have lived in the London Zoo for over eight years each, and some have survived for periods ranging from thirteen to sixteen years.

Markhor, *Capra falconeri.* Like the common goat, *C. hircus*, the ordinary life of the Markhor and other wild goats is eight to ten years.

Himalayan Ibex, *C. sibirica.* A female was killed in the London Zoo after having lived there for a little over twenty-two years.

Thar, *Hemitragus jemlahicus.* The ordinary life is as for the goat, but individuals may live to twelve to fourteen years and even to over sixteen years.

Nilgiri Thar, *H. hylocruis.* Probably the same as the above. A specimen lived in the Trivandrum Zoo for nearly seventeen years.

Goral, *Naemorhedus* (=*Cemas*) *goral.* A male lived in the London Zoo for a little over eleven years; another survived for nearly eighteen years.

Takin, *Budorcas taxicolor.* A male lived in London for nearly nine years; a female is still alive there after about eight years.

Blackbuck, *Antilope cervicapra.* Several records show that this antelope seldom lives longer than seven years in captivity, but individuals may live to fifteen years.

Four-horned Antelope, *Tetracerus quadricornis.* A specimen lived in the London Zoo for seven and a half years; another is said to have lived in Pretoria for ten years.

Nilgai, *Boselaphus tragocamelus.* This species does well in captivity and produces twins regularly, but the maximum ages it reaches are very moderate, being generally between eight and twelve years. An exceptional female in the Antwerp Zoo is said, however, to be more than twenty-one years old. The Superintendent of the Zoological Gardens, Calcutta, gives the average age (in a letter to the Forest Entomologist) as ten to fifteen years, the same period being also applicable in his opinion to other large antelopes.

For deer the following records are available for Indian species:—

Muntjac or Barking Deer. Major Flower does not give definite records for the Indian species, but it would seem that these animals seldom live more than six to eight years.

Chital, *Axis* (=*Cervus*) *axis.* The records for twenty-five selected individuals show an average of about ten years. The longest records range from twelve to fourteen years, but an exceptional individual lived in Paris for almost nineteen years. The Superintendent of the Calcutta Zoo informs us that the average age is ten to fifteen years.

Hog Deer, *Hyelaphus* (=*Cervus*) *porcinus.* The longevity of this species is similar to that of the Chital.

Sambar, *Rusa* (=*Cervus*) *unicolor.* The longevity of this species is also similar to that of the Chital, but more cases of individuals attaining ages between fourteen and eighteen years are known.

Barasingha, *Rucervus* (=*Cervus*) *duvaucelii.* This species, and other Rucervine deer, appear to have a longer life than the Chital and Sambar. Records are given by Flower of specimens that have lived for periods ranging from a little over fourteen years to twenty-three years. The average life is probably in the neighbourhood of twelve years.

Thameng or Eld's Deer, *R. eldii.* Three records, showing a life of thirteen years, are given by Flower.

Hangul, *C. hanglu* and Wallich's Deer, *Cervus wallichi.* These Kashmir deer may live for thirteen to fourteen and a half years according to the two records given by Flower.

Regarding the Indian Wild Boar the Superintendent of the Calcutta Zoological Gardens informs us that they live for fifteen to twenty years, but Flower's records for wild swine show that twenty years is the potential longevity, the average being in the neighbourhood of ten years. An Andaman Boar, *Sus andamanensis*, lived in the London Zoo for a little over twelve years.

It may be of interest to add that among domestic animals the ordinary extreme age for cats is about fifteen years; the average life of a dog in England is less than four years, though the potential life is very much more. A dog is old at ten years, but cases are known, especially among terriers, of survival to twice this age and more. Of horses it is said that given a fair chance it is not unusual for them to live to, and be capable of reproduction at, twenty-five years, the average extreme age being in the neighbourhood of thirty-five years. The oldest age claimed for a horse is sixty-two years, and authenticated cases of horses living for forty to fifty-five years are known. Donkeys may live for forty to fifty years, but the average good life is probably about twenty years. Mules appear to have much the same span of life as donkeys. For domestic oxen and cows the specific longevity lies between five and twelve years, for sheep between seven (ewes) and twelve (rams) years. Goats have an ordinary life of eight to ten years, but may live and be useful for much longer. A camel generally passes the point of utility at twenty years, and should not be used for hard work before it is six years old. The extreme age of a camel may be about forty years.

In concluding it may be stated that, contrary to popular belief, man tops the list of long-lived mammals. The biblical span of 'three score years and ten' is a fair average, but individuals may live to a hundred years and even much more. The Asiatic elephant and the horse are the longest lived mammals after man. Insectivorous bats, insectivores, and small rodents are the shortest lived mammals, their maximum expectancy of life being in the neighbourhood of five years. In such cases the equilibrium of population is maintained by great fecundity.

CEDRIC DOVER.

XII.—THE DURATION OF LIFE OF SOME INDIAN MAMMALS. TIGERS.

Writing in *The Indian Forester* for June 1932, referring to Mr. Dover's article on the 'Longevity of Indian Animals', in which he says:—'Records of extreme longevity show that tigers can live 15 to 19 years and probably more', Mr. A. F. Minchin, I.F.S. quotes a case of a man-eater having lived for about 20 years in the Ganjam District. I give below, with Mr. Minchin's permission, his note on the subject:—

'A man-eater who had his beat in the Chendragiri forest of Ganjam District was well known in 1913. He did most of his business on a forest road from "Cox's Corner"—named after Mr. Stephen Cox—to the edge of the sal jungle near Tilisingi.

Ganjam tigers are man-eaters by heredity generally, and not "by misfortune". There were nearly always several tigers in the locality referred to; but it is improbable that there has been any confusion about the identity of this particular tiger. He had distinctive mannerisms. For example, after crossing a stream bed the road passed upwards through a cutting. Whilst a train of loaded timber carts were labouring up the incline, out on to the road would stroll our tiger, would sit him down luxuriously and enjoy the ensuing pandemonium. Some magic or telepathy would warn him when to abstain from such performances.

In 1913 he was mature; probably not under four years old. Otherwise he could hardly have appropriated and defended so desirable a beat. In 1915 there were five hundred rupees on his head; and one day he would have come to an end but for ill-timed politeness between myself and another man: my fault it was. I do not know exactly how many people he is supposed to have killed both before and after this occasion. Dozens and dozens.

A man-eater may seem to have been a bad institution. It must be observed though that my friend's victims were frequently women, were never above the rank of Forest Guard, and that, in a forest where the general shooting was poorish, he certainly raised the standard of his tract far above the average. To one of his exploits we owe a memorable Service Order, which run "K. Lachmana to act as Forest Guard, Fourth Grade, in Tarasingi beat, vice Bamsonia devoured by tiger, with effect from March 3rd, 1915".

The same tiger was there in 1920, when I left the district. In 1925 I toured in Ganjam; and once again in 1929. From what local acquaintances—forest officials and also the Khonds and Ooriyas—had to say, it was still the very same tiger.

The use of the forest road had long been abandoned; and only armed parties ventured in for thinnings, fire tracing etc. About 1921 Mr. Shelswell, whilst looking after thinnings, was the victim of an unprovoked attack by a rogue elephant in this same place. Quite a warm corner in fact.

In 1929 March, early one hot weather afternoon, I was watching a fire line, along which it seemed the tiger might come back towards his kill. He came unexpectedly early and took me by surprise so that I did not make up my mind to fire quickly enough; but a mental picture of him remained. He had no tawny shades in his coat: there were the dark stripes on a dull silvery grey ground colour. Obviously an old animal. Mr.

Ware of the Veterinary service was with me at the time. It was he and I who had had the chance at the same tiger in 1915.

After this occasion in 1929 no more was heard of the "Chendragiri Man-eater". There is no story of any one having shot at him; but he ceased to terrorise the neighbourhood.

As far as one can be sure in a matter of this kind, the tiger, which must have been quite four years old in 1913, was the same tiger that was last seen in 1929. That would make him not less than 20 years old at the time of his presumed death.'

The above is about equalled by the history of the Bargur man-eater which was the periodic scare of the Ramapuram-Bargur Ranges (Kollegal Division, Coimbatore District) for 15 or 16 years. This tiger apparently varied its diet with men, cattle and game killing, rather a peculiar case. It was finally shot in 1928 by a poacher, who was out for a stalk in the early morning, met the tiger round a corner, fired, threw down his gun and bolted for dear life. The tiger was later in the day found lying dead. Needless to say, the man did not claim the reward, knowing he would be prosecuted under the Arms Act and for poaching. This tiger must have been quite 20 years old at the time of its death.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE,
S. INDIA.
June 10, 1932.

RANDOLPH C. MORRIS, F.Z.S.

XIII.—RECORD OF BIG GAME SHOT IN THE NILGIRI AREA 1905-1931.

While it would appear that Sambar have decreased considerably Bison seem to be fairly steady. No Chital are recorded as shot since 1914.

I enclose a table showing the number of head of big game recorded as shot within the area controlled by the Nilgiri Game Association from 1905, and the number of licences each year. You may consider the table of sufficient interest to publish in the Journal of the Society. The list is published with the authority of the Association.

Year		Bison	Sambar	Spotted Deer	Ibex	Black Buck	Tiger	Panther	Bear	Hyaena	Barking Deer	Antelope	Chital	Total	Licences Annual	Licences Monthly	Measurements of best heads
1905-06	..	2	78	8	8	1	5	20	...	2	152	2	...	278	...	...	Sambar 39″ horn
1906-07	...	8	72	13	2	5	11	18	5	2	92	...	...	228	...	...	Sambar 37½″ ,,
1907-08	...	7	55	18	11	7	11	16	6	4	100	4	...	239	...	...	Sambar 40″ ,,
1908-09	...	4	47	5	6	7	8	12	2	...	57	1	...	149	68	27	Sambar 39½″ ,, Bison girth 17¾″, spread 33″
1909-10	...	5	59	17	5	10	7	21	4	1	55	...	...	184	66	23	...
1910-11	...	4	30	7	3	6	5	4	4	1	15	1	...	80	59	23	Sambar 36½″ Bison girth 18¼″, spread 41½″
1911-12	...	1	75	25	10	5	20	30	3	1	8	...	...	178	61	22	Sambar 36½″
1912-13	...	1	43	19	9	9	7	17	6	1	25	1	...	138	73	20	Sambar 38¾″
1913-14	...	...	50	35	6	14	11	31	13	...	34	1	...	195	80	34	Sambar 40½″
1914-15	..	...	27	...	2	11	4	16	1	...	18	...	25	104	49	17	Sambar 37½″
1915-16	...	5	38	...	3	11	2	12	3	1	40	2	32	149	47	34	Sambar 36½″ Bison girth 18½″, spread 39½″
1916-17	...	2	46	...	3	8	8	25	4	...	46	...	21	163	51	19	...
1917-18	...	4	48	...	1	10	11	29	5	...	24	1	18	151	72	32	...
1918-19	...	2	43	...	3	11	6	20	6	...	10	...	28	129	58	50	Sambar 38″
1919-20	..	...	42	...	3	9	9	40	6	1	36	...	32	185	77	41	Sambar 39½″
1920-21	...	10	38	...	1	14	16	26	6	2	42	1	43	199	85	38	Sambar 36″
1921-22	...	9	43	...	1	4	8	32	9	...	61	1	44	212	101	45	Sambar 38″
1922-23	...	12	30	...	2	...	14	47	11	3	69	...	24	212	84	42	Sambar 38″
1923-24	..	6	24	...	1	...	17	35	7	...	62	...	29	174	91	27	...
1924-25	...	2	20	...	1	...	19	27	3	...	57	...	17	146	85	22	...
1925-26	...	4	17	...	2	...	6	10	3	2	22	2	14	82	69	22	...
1926-27	...	2	25	...	5	4	9	6	2	1	34	...	33	121	100	26	...
1927-28	...	4	17	...	9	5	9	21	2	1	37	1	86	192	33	27	...
1928-29	...	6	15	...	9	6	7	13	8	...	45	...	33	142	96	25	...
1929-30	...	2	13	...	8	2	12	7	...	...	31	4	15	94	90	19	...
1930-31	...	14	18	...	5	2	5	1	3	...	42	...	20	110	93	25	...

R. C. MORRIS,
F.Z.S.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via MYSORE.
May 23, 1932.

XIV.—SMALL BORE RIFLES AND BIG GAME.

Early morning on the 7th. of April 1932, accompanied by my 'sais', I rode to the eastern side of the Dhakka Chât Kadir in Pilibhit District, U.P., which is all open sand on the right bank of the Sarda river, in order to try and get a good photograph of a big tiger's tracks in sand, and though I saw numerous tracks of tigers I did not see a good enough impression to take a photograph. Before returning home I had a look at the kadir through fieldglasses from the high ground at Pasian and to my astonishment saw a tiger standing in the middle of one of the swamps about 300 yds. from me. I jumped off my horse and seized my rifle, a ·355 Mauser, from the 'sais' and ran along the bank hoping to get a nearer shot. As I reached the spot I had selected the tiger had left the water and was disappearing into high and very thick 'khagar' grass. I sat down on the bank and waited for about 15 minutes in hopes that the tiger would come out nearer to me but as he did not I returned towards my horses. Just as I got to them I saw the tiger standing below me and across the stream about 80 yds. off and looking up at me on the edge of the high grass. He was broadside on so I let him have it behind the shoulder. He leapt into the air with a loud 'woof', took two bounds and fell over and before I could get a second shot into him he again gave a bound and a 'woof' and disappeared out of sight in the high grass. This was at 8-45 a.m. When I fired at him and he spoke, the tigress who was following him, and whom I had not observed, also gave a 'woof' and broke back through the high grass. I waited quietly for half an hour in hopes of seeing one or the other but in vain, so rode home as fast as I could to get a heavy rifle and help, leaving the 'sais' behind to watch. Nineteen stalwart tenants of mine volunteered to assist me so I sent them off with a feed for the sais and mare and followed after breakfast. I didn't get back to Pasian till 3 p.m. owing to the delay in getting bullocks for a small bullock cart to take me out the five miles. On my arrival the 'sais' reported that he had heard and seen nothing, so it was decided that we should cross the stream and look for blood. When we got to the place where I saw the tiger fall over we found a small patch of blood and from there to the heavy grass there was plenty of blood. Before entering the heavy grass I fired two shots from my 12 bore with No. 6 shot into the grass and then we followed up the blood trail for about 50 yds. and as we did not come across the tiger dead I thought discretion was the better part of valour and turned all my stout-hearted followers back the way we had forced our way through the grass. It was just as well I did so, for next morning, when we searched the grass with a herd of buffaloes we came across a large pool of blood not 20 yds. from where we turned back where the tiger must have been lying and moved off after I fired the two shots.

He left the grass accompanied by the tigress sometime during the evening or night and went north and we lost all trace of him.

Moral.—Do not use a small bore rifle on tiger.

HARIPUR P.O., L. D. W. HEARSEY, *Capt.*,
KHERI, U.P. *2nd. Lancers.*

XV.—GAME RESERVES AND FLASHLIGHT.

In your issue dated 15-7-32 I see a letter from Mr. Morris expressing the opinion that the use of flashlight is very disturbing to game. There have also recently been articles in the 'Field' suggesting that eager bird-photographers are driving rare breeding birds away from their nests in England and that some photographers are harrying the big-game of Africa by trying to take photographs from low-flying aeroplanes. As one who has been keen on wild-life photography for the last 25 years or more, and who has many years of experience of flashlight photography in India, I would like to write a few words on this subject.

What some photographers tend to forget is that there is just as much true sportsmanship called for in the wild-life photographer as in the sportsman who hunts to kill. There are certain things that may be done and others that may not. I do not know who the photographer is that Mr. Morris refers to; but, in my opinion, plastering the jungle with a dozen flashlight cameras is not sport and should not be allowed. It is quite impossible for anyone to control personally a dozen cameras and it is merely trusting to luck that a vast expenditure of money and flashlight powder will, by a fluke, produce some result. The whole art and interest of flashlight work lies in personally controlling one or two cameras and trying to anticipate what some particular animal will do. To use a dozen cameras at once is about equal, in my mind, to hunting with a machine-gun and firing off many cartridges on the chance of scoring at least one hit. Further, I am of the opinion that it is quite unfair to use flashlight at all—except possibly in very exceptional cases—over drinking holes where water is scarce. Nor is it playing the game to drive animals away from dens containing cubs, or birds from their nests. In every case the photographer, if he be a true sportsman, must decide for himself whether any scheme he may evolve for obtaining a photograph is fair on the subject or not, and, if his conscience tells him that it is not, the chance must be let pass, however tantalising it may be. After all, the true sportsman with a gun does not shoot at every animal he sees or in every way he can contrive, and the photographer must adopt the same standard of fair-play if he is not to bring the fine hobby of wild-life photography a bad name.

I write with ten years' experience of flashlight work in India and I emphatically state that flashlight photography, employed in moderation and with a sense of fair-play on the animals, does not disturb the game anything like so much as ordinary shooting.

An occasional flash and bang in the jungle is probably mistaken by the animals for lightning, and it does not cause them any serious worry, for it is not accompanied by wounds or the startling crash of a missed bullet hitting the ground near the animal. As an example of this I would suggest that anyone interested should read Chapter III of my book *With a Camera in Tigerland*, describing how a tiger was photographed by flashlight, which disturbed him so little that he killed a buffalo bait on the same road shortly afterwards and finally showed no fear whatever when photographed by daylight the following day. And I could supply dozens of other similar examples. But the man who scatters flashlight traps in large numbers all over the place, and who is presumably taking photographs purely for monetary gain or because he has so much money that he does not know how else to waste it, is a nuisance and should be refused entry into any sort of game preserve. The same remark applies to professional film-makers, who, in some cases at any rate, certainly regard wild animals as a means to making money and who are not always above positive cruelty provided only that they can make their films sufficiently sensational to meet the tastes of a not over-refined public.

Flashlight or any other kind of wild-life photography is a magnificent sport which calls for the maximum of pluck, skill, and wood-craft. In proper hands it must be infinitely less cruel than any kind of hunting. The callous professional photographer can be refused entry to forests containing wild animals, but I would appeal to all those amateurs who really love wild animals to remember that, in their enthusiasm for their hobby, they must always bear in mind that it is not playing the game to cause animals suffering in order to produce pictures, however fine they may be. I would also appeal to Mr. Morris to be a little less hasty in his letters to the press, and not to judge flashlight photographers as a class from his experiences of one individual. After all, I have known individual shikaries, on occasions, do extremely objectionable things, but I would never dream of making a general statement that *all* shikaries drive game out of a reserve or are unsportsmanlike. If Mr. Morris had had as much experience of the effects of an occasional flashlight on wild animals as I have, he would hesitate before making the extremely dangerous statement that 'I cannot imagine anything more disturbing to the game in a jungle than the flash and explosion of flashlights'. I could tell him of a dozen things much more disturbing, one of which is the use of magazine rifles, another the noise made by a line of beaters, and a third the extremely objectionable and growing practice of shooting from or with the aid of motor-cars. I would even suggest that, every time Mr. Morris fires his gun or his rifle, he disturbs the game just as much as the photographer's harmless flashlight, and, what is more, if he shoots straight he deprives some wild creature of its most precious possession—life itself. If, by chance, he does not shoot quite straight, he may, perhaps, wound some creature and be forced to leave it to die a lingering and miserable death—a thing the photographer never has to do. I think I have written enough to show Mr. Morris, and others who agree with him, the other point of view, and I would close this note by suggesting that, until he and others like him have laid aside their guns and their rifles for ever, they should remember the old old saying about people who live in glass-houses.

NAINI-TAL, U.P.
August 10, 1932.

F. W. CHAMPION,
Indian Forest Service.

XVI.—THE PENDULINE TIT (*REMIZ CORONATUS* SEVERTZOFF) IN THE PUNJAB.

To the occurrences of the Penduline Tit (*Remiz coronatus*) in the Punjab, recorded in our Journal by Mr. H. Whistler from Jhelum (vol. xxiii, p. 153) and Mr. A. E. Jones from Lahore (vol. xxxv, p. 202), I can now add one from the Shahpur District. I obtained 2 ♀♀ in trees bordering the Lower Jhelum Canal at Ghullapur on March 14, 1932.

DANDOTE,
JHELUM DISTRICT,
PUNJAB.
June 1, 1932.

H. W. WAITE,
Indian Police.

XVII.—NOTES ON SOME CEYLON BIRDS.

The Ceylonese Warbler, Elaphrornis palliseri, Blyth.

These rather odd little birds are common in the jungle on the slopes of the Great Western in Ceylon at about 4,500 feet and upwards and venture into the tea where it borders on the jungle. In habits they much resemble the smaller babblers. In the off season they go about in small parties keeping to dense undergrowth where they creep about among the stems like mice, obtaining much of their food off the ground, and continually flirting their long and much graduated tails. They are very silent, the only note that one normally hears being a low single explosive 'qtz' which is also their alarm note when the nest is approached. In the breeding season in March and April they have a feeble little song of a few scattered notes.

The nests are remarkably substantial affairs of moss and dead leaves with very thick walls and a deep cup beautifully lined, usually with skeleton leaves. The four I have found have been from two to five feet from the ground. One was in a tea bush and the others in the jungle in clumps of bamboo at the side of a game trail. There were two eggs in each case, somewhat reminiscent of small bulbuls' eggs, white in ground colour, heavily covered all over with small, dull purplish spots and occasionally there were one or two purple hair lines.

They are close sitters and when put off the nest do not go far but scuttle about under cover in the near neighbourhood. I put up a hide within three feet of one nest containing young and the parents soon overcame their alarm and came freely to the nest. Both male and female brought food but the latter, distinguished by her white iris, was much the shyer. The cock, who had fine ruby eyes, was very bold. It was difficult to distinguish what they brought but on several occasions it seemed to be a whitish grub and once a worm. Though they uttered their alarm note while I was putting up the hide, once they had overcome their suspicions they were completely silent.

Legge's Baza. Baza jerdoni ceylonensis.

A pair of these birds lived on the edge of the jungle bordering the Pundalnaya tea district within a mile of my bungalow and I used to see them almost every day for a year. I did not shoot either, as I should have done to make identification absolutely certain, as they were the only pair I knew of. I had plenty of opportunities, however, of observing them at close range as they were far from shy and I have no doubt that they really were Bazas. They were rather sluggish birds spending much of their time perched on trees, at the edge of the jungle or sometimes in the tea. For long periods they would soar round and round each other rising to a great height and uttering a peculiar mewing, 'kikiya kikiya'.

When changing ground the wings were flapped strongly with short intervals of gliding. In general shape and flight they much resembled small buzzards. In flight the crest was depressed but when settled the long feathers rose vertically from the occipit in a very characteristic manner. I never saw them catch any prey or even appear to be hunting. During August and September, one of the pair, the male presumably, used to perform some remarkable antics in the air which I can only presume were some form of nuptial display. He would be soaring normally, mewing loudly. Suddenly he would swoop downwards with half closed wings for thirty or forty feet uttering a loud, sharp 'kit, kit, kit' and then turn upwards vertically until the momentum of his swoop was expended and he appeared to be just about to fall over backwards, when he would right himself and go on soaring as before, only to repeat the performance in a few seconds. On September 26th I saw one of the birds sitting on a tree uttering this 'kit-kit' note and it suddenly flew across to another tree where its mate was perched and copulation took place to the accompaniment of loud cries. Although they haunted a definite small tract of jungle at this time I failed to find the nest though I saw them with a fully fledged young one in November. Soon after, when the leaves were thinner, I discovered a small stick nest forty feet up in a big tree standing by itself on the jungle edge in which I had often seen the bazas and I am almost certain that it was their nest.

The young one soon disappeared and the old pair in April became very noisy and seemed to show much interest in another patch of jungle a few hundred yards away but the male never performed his nuptial 'aerobatics' and I would find no rest, but, on May 10th, I saw a party of five which appeared to consist of three young birds and two adults which looks as if they are possibly double brooded.

HALLERY, F. N. BETTS.
MERCARA, COORG.
July 19, 1932.

XVIII.—THE STATUS OF THE INDIAN BLACK-HEADED SHRIKE (*LANIUS NIGRICEPS*, FRANK.) IN LOWER BENGAL.

With observations on the plumage of specimens captured in their breeding area.

The status and distribution of the Indian Black-headed Shrike (*Lanius nigriceps*, Frank.) appears rather obscure, at least so far as the plains districts of India and specially Bengal are concerned. Mr. Stuart Baker has recorded in F.B.I. (Birds)—'In winter it is found all over the foot hills and also in the plains for some distance from them'. One will obviously infer from this record that it is a migratory species, which spreads itself in the plains during the cold weather months and retires in summer to the hills in great numbers to breed. The bird is not unknown in Bengal; 'common', according to Blyth, who states that it is 'common in the Soonderbuns of Bengal, and on many of the *Churrs* (or alluvial banks and islands) in the Ganges and its branches' (J.A.S.B., xv, 301). Jerdon records its distribution from the foot hills of the Himalayas through Purnea and Dinajpur to Calcutta and the Soonderbuns, extending eastwards into Assam and Arakan. Mr. P. W. Munn notes it as 'a rare winter visitor' so far as 'the Calcutta District' is concerned (Ibis, 1894, p. 45). Capt. Tytler mentions it as 'rather uncommon' in Barrackpore (Dist. 24-Pergs.), to be 'only met with at some little distance from the Cantonments' (A.M.N.H., xiii, 1854, 370). Four specimens were collected by Blyth from the vicinity of Calcutta (Cat. B. Mus. A.S.B., 151), but, as the dates are not recorded, nothing can be inferred as to the status of the species. Its occurrence in Furreedpore in Eastern Bengal was recorded by J. R. Cripps (S.F., vii, 269), who found the bird 'excessively common, and a permanent resident', breeding in the district. Ten nests with from one to five eggs in each were obtained by him during April to June, of which four were placed in bamboo clumps and the rest in *Babool* trees. A subsequent note by Cripps, however, appears to conflict with this observation as to the status of the species in this part of Bengal. He writes—'They begin to arrive in the Dibrugarh district in the last week in July, and the majority leave by the beginning of April, evidently for Bengal, where I found numbers breeding in the Furreedpore district' (S.F., xi, 91). Certainly the birds thus recorded as migrating by the beginning of April from Dibrugarh (Assam) to Bengal for the purpose of breeding cannot be called permanent residents in the Furreedpore district of East Bengal.

In this state of our knowledge and information regarding *Lanius nigriceps*, Frank., it may be of interest to record what little observation I have been able to make of a few individuals in the districts contiguous to Calcutta. The field records I have in my diary relate to stray birds noticed throughout winter, singly as a rule or in very small parties of two or three individuals keeping aloof from one another, in parts of the districts of 24-Perganas and Jessore. Evidently, even at this season, the species is by no means common or abundant, though one sometimes finds one or two captured birds brought down for sale to the Calcutta market. Their hunting ground is invariably open plains, where they keep to the bushes or hedges bordering cultivated fields, and also the *babool* and date trees standing thereon. After winter one looks in vain for a single example affecting even the favoured spots where it was noticed in the cold weather months. This arouses suspicion as to its being probably a migratory species, which may now have withdrawn itself from this part of Bengal to breed elsewhere. Of late, in an excursion to Basirhat (Dist. 24-Pergs.) on July 12, 1931, I came upon a pair of *Lanius nigriceps*, Frank. feeding three young (just out of nest) on a dwarf date tree. The persistent call of the latter caught my ears from afar and on approaching the tree, I came across what struck me as a most amazing incident—the discovery of the bird's nesting site. Instantly with the aid of a bird-catcher who accompanied me, I had the mother bird and one young snared alive. The other two young took to their wings, having apparently been strong enough to fly. I could not find out the nest where the brood was reared. Evidently I was a little too late in arranging this excursion and the place was almost inaccessible now, partly due to its being water-logged and partly to the standing crops. During my previous trips to this place, not only in winter, but also in April and May last, I observed one or two pairs of this shrike. I saw them again even as late as June once. I therefore suspected the bird to be a resident species, which must have been hanging on, intent on breeding in the locality. In fact I heard the song notes of a male bird in fine plumage on 17th May last.

Now it is known for certain that this area, which lies beyond and to the east of Basirhat town, on the bank of the river Ichamati about 40 miles N.-E. of Calcutta, provides a congenial nesting site for the Black-headed Shrike. It is principally an alluvial tract, low-lying and depressed, forming natural basins in which water collects and from which it has no other exit than what draining is possible by the configuration of the tract. As a result, the water at least on the river-side finds its way into the river. It is almost a threshold to the Soonderbuns country with the delta still in a less advanced stage of growth and with a series of tidal creeks winding their way to the sea through numerous islands and morasses. The thickets and shrubs, and clusters of date and *babool* trees on the *Churr* lands harbour these birds in some numbers throughout the year, so that they are permanent residents here, and not quite uncommon. The progeny that are raised in this breeding area swell the number of the resident birds which, in winter, hasten to fresh fields, evidently extending their range, approaching nearer villages and thereby falling to our notice. With the advent of summer they retire to the areas congenial for their nesting, which lie, more often than not, along the alluvial banks of rivers, so far as this part of Bengal is concerned. Their nesting period synchronises with the rainy season, when the *Churr* lands are inundated and almost inaccessible so that the nesting operations are carried on unnoticed. The Soonderbuns and the alluvial tracts of the delta provide considerable areas for the nesting of the species which hardly needs to migrate to the hills, at least from this part of Bengal. Within the breeding area the bird is thus a permanent resident, though away from it, whatever migration it undertakes is only very local.

Variable as the plumage is of *Lanius nigriceps*, it will be of interest to record the body-colour and measurements of the two specimens captured alive during my last excursion to Basirhat. The juvenile, just out of the nest, has no barring on its underparts which resemble the colouration of the breeding parent, and which, from its faded body-colour and constant attention to its offspring, I imagine to be a female bird. Comparing her with the skins of ♀♀ collected by me during last winter I find the colouration of the upper back of this breeding ♀ very singular. The extent of white or grey, or rather ashy white is much greater, while the tone of rufous or chestnut on the body generally is distinctly lighter. Not a single example in a fairly large series of skins in the collection of the Indian Museum, not only from Bengal, but also Assam and Burmah has such faded colouring of the upper plumage.

Breeding ♀ 12-7-31.

Wing 95 mm.; tail 125 mm.; tarsus 32 mm.; culmen 18 mm.

Forehead, lores, crown, nape, hind-neck, sides of head and neck dull black, rather brown in tone, lighter towards neck, the feathers having grey bases; upper back, shading from the black, ashy-white mixed with faded chestnut, remainder of back, scapulars, rump and upper tail-coverts light chestnut; tail dull black, rather brown in tone, more broadly tipped and margined with dull chestnut from the middle pair to the outer, the two outer pairs frequently suffused with chestnut and the outer webs entirely of this colour; wing-coverts dull black with brown toning; primaries dark brown with white patch at their bases; inner secondaries with broad light chestnut edges. Under parts white washed with light chestnut, the latter rather darker in lower breast; under tail-coverts fulvous-chestnut.

Iris dark brown; eyelids pinkish plumbeous; bill dark horny black lighter towards base; mouth flesh-colour; legs and feet dark plumbeous; claws black.

Juvenile (just out of nest). Sex (?). 12-7-31.

Wing 86 mm.; tarsus 30 mm.; culmen 17 mm.

Forehead black, the latter extending over eye, faintly edged with pale rufous; ear-coverts black; crown, nape, hind-neck, sides of head and neck mottled black and pale rufous, the feathers with pale rufous edges and tips and with black bases; back, scapulars, rump and upper tail-coverts rufous, barred with black, the feathers having pale or grey bases; the rufous being lighter towards upper-back; wing-coverts dull black with rufous edges and tips; bastard wing tipped and edged with rufous on both webs; quills dark brown, rather dull in tone, edged and tipped with rufous; a white patch at their bases; inner secondaries with broad rufous edges; under wing-coverts and axillaries albescent; under parts similar to breeding ♀ described above.

Legs, feet and claws salty-black; upper mandible dark horn, lower fleshy plumbeous, darker towards tip; gape yellow; mouth flesh-colour; iris brown.

It is interesting to observe that both the mother bird and young, while in captivity within my spacious aviaries, do not appear to be shy or nervous, and readily adapt themselves to the artificial diet plus a few live insects. I had the opportunity of re-examining their coloration two months later, and the striking changes since brought about by moult were noted as follows:—

Juvenile. 5-9-31.

Black increasing on crown and nape; ear-coverts black brown tipped with light chestnut; black more prominent on wing-coverts; under parts as before, showing no barring at all.

Upper mandible darker though not thoroughly black as in adult, and horny towards base; iris light brown.

Adult ♀. 5-9-31.

Under moult. Upper back still strikingly ashy-white mixed with faint rufous, but the rufous tinge is increasing; secondaries edged on inner web from base with white instead of chestnut.

Calcutta. SATYA CHURN LAW,
April 14, 1932. Ph.D., F.Z.S., M.B.O.U.

XIX.—OCCURRENCE OF THE WHITE-THROATED BABBLER (*ARGYA GULARIS*, BLYTH) IN LOWER BURMA.

Argya gularis has hitherto been considered a bird of Upper Burma and particularly of the dry zone, Oates having no records of its occurrence south of Prome. I found it in 1929 in small numbers about 20 miles south of Prome (J.B.N.H.S., xxxiv, p. 670) and in January 1931 obtained specimens near the northern border of the Henzada district where the thorn jungle approximates to that of the dry zone.

In the middle of May 1932, I thrice observed a party of three birds in a patch of bamboo jungle on the laterite ridge about two miles south of Mingaladon aerodrome and about eight miles from Rangoon. I made two attempts to collect one of these and on May 19th had a good view of a single bird in the same place, which would not allow a close approach, though I managed to observe the white throat and breast as it sat on a bamboo clump, uttering its loud 'tittering' note. In the dry weather this country approximates closely to parts of Thayetmyo-Prome ridge but I have ridden through it at all seasons of the year without seeing or hearing *gularis* before; it is difficult to believe that these birds were migrants, and I presume they had wandered down the line of the Pegu *Yomas*. Mingaladon is at least 125 miles south of any area from which *gularis* has previously been recorded.

Rangoon. J. K. STANFORD,
May 21, 1932. *Indian Civil Service.*

XX.—A NOTE ON THE BUNTINGS OF BURMA.

The Buntings of Burma, which, except *Melophus melanicterus*, seem to be all 'cold-weather' visitors from September to May, have largely escaped the notice of observers, especially of recent years. With the exception of Wickham, who records, without much detail, the occurrence of five species from the Burma Hills, there is very little to go on. In the hope that other observers may turn their attention to these birds, I have collated the following notes which suggest that several species of buntings occur more or less all over Burma and are overlooked.

(1120) **Grey-headed Bunting. Emberiza fucata fucata.**

(1121) **The Indian Grey-headed Bunting. Emberiza fucata arcuata.**

Fucata is recorded from Toungoo and between Toungoo and Thayetmyo (Hume) 'rare in Tenasserim as far south as Thaton' (Davison), common in the Pegu-Sittang area (Oates). Wickham states that both sub-species 'occur in our hills as winter visitors' but gives no details. The *Fauna* records *arcuata* from Mount Victoria but does not say if it was breeding. I saw one at Henzada in April 26, 1931, in a flock of *aureola*, and shot several in paddy stubble in February 1932 near the mouth of the Rangoon river. I also saw a good many in mid-March 1932 in paddy stubble at various places in the plains of the Myitkyina District.

On the wing this bird very closely resembles the British Reed Bunting (*Emberiza schœniclus*) in winter and has much the same weak flight, fulvous brown back, and habit of flitting under tufts of grass or rushes. It is not easy to observe on the ground but allows a close approach when the reddish chestnut ear-coverts and greyish hind-neck can be seen. The outer tail feathers show white in flight.

(1122) **Little Bunting. Emberiza pusilla.**

The *Fauna* describes it as a winter visitor to the hills of Burma whose southern recorded limit is Karenni. This appears to be incorrect as Davison got it on the summit of Muleyit. It was not apparently noted by Oates, Mears, Macdonald, Hopwood, Mackenzie or Harington, but Wickham obtained one at Maymyo.

As already recorded (J.B.N.H.S., xxxiv, p. 911) I obtained several between February and April 1929, both in the Irrawaddy valley and on the hills west of the Prome district. On March 15th, 1932, I obtained two females at Hopin in the plains of the Myitkyina district, which were in a tree on the edge of teak jungle with some Crested Buntings. A small shy bunting like this can very easily be overlooked.

(1128) **Yunnan Meadow-Bunting. Emberiza cia yunnanensis.**

The *Fauna* records a nest taken by Harington at 10,000 feet in the Shan States, but Wickham (J.B.N.H.S., xxxiv, p. 49) gives sound reasons for disbelieving this. The bird should however occur in Burma as a winter visitor if it breeds in Yunnan.

(1131) **Yellow-breasted Bunting. Emberiza aureola.**

This seems to occur throughout the plains of Burma until May in which month it was noted by Oates in Lower Burma and by Macdonald in Myingyan. I have never seen it in 'well wooded country' as the *Fauna* describes it. In Myitkyina recently I watched a very large flock at close range which were sitting in bushes near a stream, hawking flying ants, a most unusual sight.

(1132). **Yangtse Black-headed Bunting. Emberiza spodocephala melanops.**

The *Fauna* records it from 'Northern and Central Burma' but it is not mentioned by any of the observers abovenamed. I saw several in the Myitkyina district in early March 1932, usually in bushes along streams, and occasionally in the company of *E. aureola*. They allowed a close approach and their most conspicuous field character was the black patch on the lores which showed up against the dark greenish head and neck. Single birds usually dived into bushes when disturbed or flew up into trees.

(1135) **Chestnut Bunting. Emberiza rutila.**

The distribution in the *Fauna* is 'Burma as far south as the Tenasserim district, Shan States, Chin Hills'. Oates records it from Bassein (Blanford), near Rangoon (Hume), Toungoo and Karenni (Wardlaw Ramsay) north Tenasserim (Davison) and the Thaungyin valley (Bingham). Wickham records it as occurring in winter in the Chin, Kachin, and Shan Hills but gives no details. Mears describes it as 'general throughout the Chindwin'. I have previously recorded (J.B.N.H.S., xxxiv, p. 912) its occurrence in Prome both in the Pegu Yoma foothills and at about 2,500 feet in heavy jungle in the Arakan Yoma, where large flocks were to be seen in mid-April. In this district it seemed to be addicted to bamboo and dense woodland and by no means similar in habit to *E. aureola* as noted in the *Fauna*.

(1139) **Crested Bunting. Melophus melanicterus.**

'In Burma it extends throughout the hills from Manipur, Chin and Kachin Hills to Tenasserim' (*Fauna*). Blyth records it somewhat vaguely from 'Arakan' and 'Pegu', but Oates' only other records were from the Karen Hills and Karenni (Wardlaw Ramsay) and one from Bilin (Davison). Bilin is in the plains of the Thaton district. Harington noted it in flocks up to mid-March in Bhamo and said it appeared to be breeding near Sinlumkaba. Wickham describes it as 'a very universal bird in all our hills'. Villar and myself obtained specimens on the Prome-Sandoway border, but it was not noted by J. C. Hopwood and Mackenzie or Mears in the Upper Chindwin or North Chin Hills. I recently noted large parties in paddy-stubble in the Namyin valley, Myitkyina, between Hopin and Mogaung, many birds being paired in mid-March. It will probably be found breeding here in this area at a very low elevation. (1 ft. to 400 ft.)

RANGOON.
March 24, 1932.

J. K. STANFORD,
Indian Civil Service.

XXI.—THE SHORT-EARED OWL (*ASIO F. FLAMMEUS*) IN BURMA.

In his *Birds of British Burma* Oates has only one record of the Short-eared Owl (*Asio f. flammeus*) in Lower Burma, Wardlaw Ramsay having obtained one at Toungoo, but quotes Blyth as stating that it occurs in Arakan. No mention of this bird appears to be made by Messrs. Hopwood, Mackenzie, Harington, Mears or Wickham in the various papers on Burma birds they have contributed to the Journal. The only note of it I can find is by K. C. Macdonald, who, writing of Myingyan district, states that it is very common in the grassy *thamin*-haunted country round Kanna and the Pin Chaung. The following notes made by me at various times suggest that it may be a regular winter visitor (not a 'wanderer' as described in the *Fauna*) over a great part of Burma and is overlooked in the huge areas of grass, stubble or peas in which it can rest undisturbed by day.

(1) *November* 1924. Upper Chindwin District. Saw a number round a jheel south of Tamanthi.

(2) *December 2nd*, 1928.—Prome District. A single bird in rough grass on the Nawin marshes near Prome.

(3) *December 24th*, 1930. Henzada District. Shot a female which was on a sandbank near the Irrawaddy. It flew about for some time in strong sunlight at midday, and when it settled, did not seem to mind the glare of the sand. It had been feeding on voles of some species.

(4) *February 3rd*, 1931. Henzada District. I flushed one, while looking for quail, in the big peafields along the Irrawaddy near Yele, 30 miles south of where I got the other one.

(5) *February 6th*, 1932. Hanthawaddy District. Flushed two out of paddy stubble near Kamakalok, close to the mouth of the Rangoon river. The fields for miles round were riddled with ratholes which had probably attracted the owls.

(6) *March 3rd*, 1932. Shwebo District. Saw three in the thin dry thorn jungle about half a mile east of Shwebo Civil lines, and flushed them near the same spot on the 4th. Both the Hanthawaddy and Shwebo birds seemed to have chosen extraordinarily hot and shadeless places to lie in by day, and all seemed to mind the sunlight as little as does *Glaucidium cuculoides*.

RANGOON. J. K. STANFORD,
March 21, 1932. *Indian Civil Service.*

XXII.—THE OCCURRENCE OF THE LESSER KESTREL (*CERCHNEIS NAUMANNI*) AND KNOT (*TRINGA C. CANUTUS*) IN BURMA.

There appear to be no records of the occurrence of the Lesser Kestrel (*Cerchneis naumanni*) in Burma. I obtained two males on April 1st, 1932, at Lunbye, south of the Sittang in the Pegu district, out of a gathering of 30-40 which were presumably on migration. They were scattered in twos and threes over a grass plain and were not at all shy. Though this grass was riddled with rat-holes, the food of those shot appeared to be some form of beetle or cockchafer. Several males moulting into fresh plumage were in the gathering and at a distance were most conspicuous, with their grey heads and ear-coverts, pinkish breast and pinkish-chestnut back. Those obtained were shedding the tail and had nearly completed the body-moult. (w. 227-237, t. 31, c. 17-19.)

I accidentally obtained a male Knot (*Tringa c. canutus*) on April 14th, 1932, at Kamakalok near the mouth of the Rangoon river. The wing measured 160, culmen 31, tarsus 30, and the breast, forehead, cheeks and neck were bright pinkish-cinnmaon, so that there seems no doubt as to its not being *tenuirostris*. This bird was in a flock of Curlew-Sandpipers, Sand-Plovers, etc., on the tide-line. There appear to be only two previous records of this race from India, one from Baluchistan and one from Ceylon (*Fauna* viii, 698). Armstrong obtained a Knot in winter plumage on the western side of the Rangoon river in 1876, but this and the single Arakan record are apparently of *tenuirostris*.

These three skins have been sent home to Dr. C. B. Ticehurst.

RANGOON. J. K. STANFORD,
May 22, 1932. *Indian Civil Service.*

XXIII.—DISTRIBUTION OF THE EASTERN GREY DUCK (*ANAS P. ZONORYNCHA*).

May I ask your further indulgence to reply to Mr. Inglis' note in vol. xxv, No. 3 of the Journal, on the Grey Duck?

Presumably Mr. Inglis refers to the second edition of Mr. Stuart Baker's *Game Birds of India, Burma and Ceylon—Ducks and their Allies*, which I do not possess. Nor had I the second edition of *Fauna of British India—Birds*, when I wrote my note of the 18th. March, 1931, in vol. xxxv, No. 2: I referred to the first edition of *Indian Ducks and their Allies*, which as I stated in that note, attributed the specimens obtained by Messrs. Stevens, Moore, Mundy and Baker in Lakhimpur District between 1902 and 1905, as well as the Kengtung specimen of 1899, to the Eastern Grey Duck (*Anas pœcilorhynca zonorhyncha*). Mr. Stuart Baker opened his chapter on *zonorhyncha* in that edition with the words 'during the examination of the Grey Duck in the British Museum I have tried to ascertain whether there are any grounds for creating a new species for the ducks sent home by Captain Harington. I can find none!' That he subsequently changed his opinion is shown by vol. vi (second edition) of *Fauna of British India—Birds*, quoted by Mr. Inglis.

I presume, therefore, that the Lakhimpur specimens were actually the Burmese Grey Duck (*A. p. haringtoni*), though Mr. Inglis appears to be mistaken in attributing to that bird 'a blue and not a green speculum'. The edition of the *Fauna of British India* quoted says of *haringtoni* 'the speculum is green', and of *zonorhyncha* 'having the speculum blue and not green'. I presume also that Mr. Inglis' bird, obtained at Darbuhnga in 1929, was *zonorhyncha*, with a blue speculum.

The birds obtained in Sibsagar in December, 1908, and in Manipur in February, 1930, and January, 1931, were undoubtedly *zonorhyncha*, with the speculum blue in all lights (the speculum of *A. p. pœcilorhyncha* is green in one light and blue in the opposite light). In the case of the 1930 bird the shikaris noticed that it was an unusual species of Grey Duck, on account of the colour of the abdomen and under tail-coverts, which were more yellowish-buff than in the local variety of *A. p. pœcilorhyncha*.

As regards the Burmese Grey Duck (*A. p. haringtoni*), its identification seems to be more a matter for the scientific ornithologist, with a large series of Grey Ducks at his disposal. To the mere amateur field naturalist like myself, the differentiating characteristics are hardly sufficiently defined to permit of any certainty of identification. The variation in the colour and degree of spotting of the underparts of birds which are undoubtedly *A. p. pœcilorhyncha* is so very considerable that this characteristic cannot safely be adopted as a test, while in young specimens of *A. p. pœcilorhyncha* the spots at the base of the bill are admittedly absent or rudimentary.

THE RESIDENCY,
IMPHAL, MANIPUR.
April 13, 1932.

J. C. HIGGINS,
Indian Civil Service.

XXIV.—FLOWER-BIRDS AND BIRD-FLOWERS.

Mr. Salim A. Ali's paper on this subject must have been read with attention by all interested in birds and pollination, and will probably serve the useful purpose of leading to the recording of further data on the subject. In the north-west, our flower birds are few, but for that very reason are perhaps more closely watched when seen. The Purple Sunbird, which apparently we should call *Leptocoma asiatica*, is a frequent visitor to my garden and I have seen it try a great variety of flowers including sweet peas, though its favourite is unquestionably *Russelia juncea* and it is very often to be seen on *Woodfordia floribunda*. It is to record its constant visits to quite a different plant representative of a big order not mentioned in Mr. Ali's account, that the present note is written. The plant is *Randia uliginosa*, (*Rubiaceae*). On one occasion, on May 24th, 1923, this bird entertained me feeding from the large fleshy white flowers for about half an hour while a tiger beat was in progress towards the *Randia* in which my machhan was tied, and ten days previously, I had watched a pair on another *Randia* and subsequently dissected the flowers to see to what extent their structure could be considered ornithophilous. On general experience I do not find myself in complete agreement with Mr. Ali's five points for an ornithophilous flower, particularly as related to the fact that our Sunbirds, etc. at least normally alight to feed from the flowers. *Randia uliginosa* flowers are large, conspicuous, very solidly built, and have copious nectar, but they are definitely scented and so presumably equally attractive to Lepidoptera, etc; the large nectary is well concealed by a mass of felted hair closing the ½ in. corolla tube. These observations were made in Haldwani Forest Division, U.P. *Æthopyga seheriae* is much more rarely seen here and its selection has twice been the obviously ornithophilous yellow and red Leguminous *Caesalpinia gallesii.*

DEHRA DUN. H. G. CHAMPION,
April 16, 1932. *Forest Research Institute.*

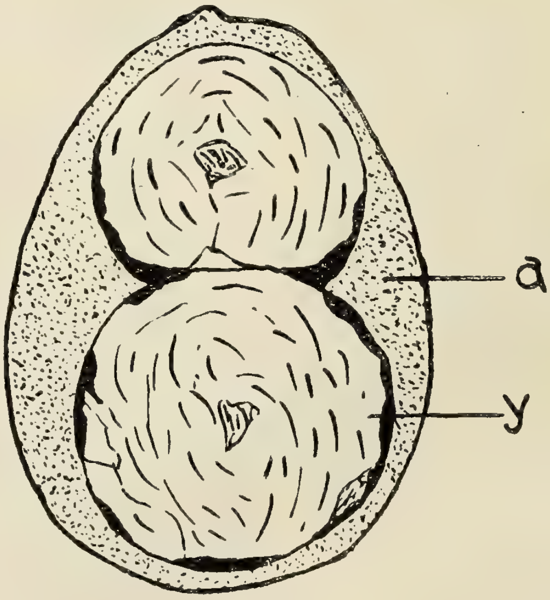
XXV.—A CASE OF TWIN-EMBRYOS IN THE EGG OF A DOMESTIC FOWL.

(With a text-figure.)

The abnormal egg described herein, was by chance, obtained from an egg-seller who used to supply us with eggs for our daily consumption in the Nainital Hills. The egg was of an ordinary fowl, not at all different from the ones commonly met with on the plains; but such fowls, when acclimatised to the hill-climate, usually lay bigger eggs than their sisters on the plains. Although the hill-eggs are bigger than the plain ones, yet the one described here was bigger still (one and a quarter times).

One morning when hard boiled eggs were served for our breakfast, the unusual size of this particular one aroused my curiosity. It was carefully shelled, but nothing abnormal was observed externally or in the white albuminous portion. I cut the egg longitudinally and discovered that there were two yolks instead of the normal one, under the cover of the white albumen. The two yolks were confluent with each other, looking like the figure eight as seen in the text-figure.

As already indicated, the two yolks were completely yet evenly embedded in the albumen; there was, however, no albumen wall separating them at the point of contiguity. The yolks were slightly smaller than those of normal eggs.



Longitudinal section of egg.
a. albumen; *y.* yoke.

It is interesting to note that the yolks contained one embryo each which was quite normal. Haply this abnormal egg, if it were allowed to hatch, might have proved of greater interest.

BOTANY DEPARTMENT,
RAVENSHAW COLLEGE,
CUTTACK.
February 15, 1932.

B. N. SINHA.

XXVI.—NOTES ON MONITOR LIZARDS.

I have read with interest Mr. Malcolm Smith's article on the Monitors and I give below the little experience I have had with these lizards.

In the Central Provinces *Varanus monitor* (=*bengalensis*) is the common form and is fairly plentiful though extremely timid and shy. No monitors from the extreme east and north of the Provinces have been examined by me. The Common Monitor (*V. monitor*) lives in burrows and in cracks in the ground from which it often comes out to bask in the sun during winter, retreating on the slightest alarm. I have also noticed these monitors occupying the roof in less frequented rest houses from the eaves of which they would now and then flop to the ground. During the rains they are more in evidence. I believe that this is their breeding season.

The flesh and skin is much in demand by the local aboriginal tribes who eat the flesh or use it in medicine and use their skins for making their small drums (*khanjeries*) and fiddles (*chikara*). At Nagpur, during the rains, small parties of Gonds regularly hunt these lizards. They take with them a spade, a knife and a small pack of a few rather under-sized dogs. The *modus operandi* is as follows:—

The hunt takes place immediately after a spell of wet weather. The party, which consists of at least three men, proceeds along the uncultivated borders of fields examining every likely hole or burrow. The presence of a lizard inside a burrow is discovered by its footprints at the entrance to the burrow. If no footprints are present the party moves on to the next burrow. If footprints are visible, one of the party stations himself at the entrance to the burrow and a search is made elsewhere for another entrance to the same burrow; when this is found another man posts himself here while the third begins digging vigorously somewhere near the middle. The lizards on being disturbed make for the entrances and are caught by the men stationed there. On catching a lizard a notch is cut with the knife on the top of the tail, which is now twisted round the neck and a claw of the fore limb is inserted into the notch to prevent the tail from uncoiling. The lizard is now quite unable to move; it is slung on to a stick and carried away. They are kept in this condition till sold when they fetch about twelve annas each.

The Common Monitor (*V. monitor*) deposits its eggs during the month of September, the number laid is about 21. They are white oval and soft-shelled like snakes' eggs and measure 45 mm. in length and 26 mm. in breadth. A pregnant female about three feet in length which I confined in a case, voided one egg on the 15th September, three on the 16th, sixteen on the 17th and one on the 18th. The above case being under abnormal conditions I am of opinion that all the eggs would under natural conditions be voided on the same day.

These lizards thrive well in captivity and can be fed on meat when other vermin is not available but they are dirty creatures, their faeces are voided in a liquid form and are highly odorous, and their cages must be constantly washed. Specimens in captivity have eaten the following:—Rats, mice, shrews, squirrels, frogs, toads, grasshoppers, skinks (*M. maculatus*) fishes, bloodsucker lizards, snakes (*Ptyas mucosus*, *Eryx conicus*, *Lycodon aulicus*) small turtles, small birds and beef. An adult monitor was able to dispose off a full grown *Eryx conicus* and a *Ptyas mucosus* four feet long.

A Red Earth Boa (*Eryx conicus*) when given alive to a monitor was shaken about and bitten first and then the head was held down and it was swallowed tail foremost. This snake was about a foot in length and it did not seem to attack the lizard at all. A living *Lycodon aulicus*, on the other hand, when seized by the monitor bit it vigorously in spite of the mauling. The lizard's body bled profusely from the numerous small wounds it had received from the snake which was game to the last. I have not yet tested these lizards with either scorpions or poisonous snakes. These lizards frequently fall a prey to the python but it takes about a day for a python to crush the life out of even a half-grown monitor.

The Yellow Monitor (*Varanus flavescens*) is the common form in Behar in the Gangetic valley though *V. monitor* is also to be found in these parts. I have two hatchlings of *V. flavescens* taken at Patna on the 7th February and a very young specimen from Parbatipur in Bengal.

During the rains the colour of *V. flavescens* is yellow or yellowish brown with broad cross bands of red; these red cross bands are indistinct or wanting at other times of the year. The young are as described in the *Fauna* except that in the lower surface the dark brown cross bars though continuous below the neck are not so under the chest, abdomen and tail.

It will be noticed that in these lizards the outer hind toe is separated by an appreciable distance from the other four toes; this toe is used in apposition with the others in adjusting the tail of the female during coition.

CENTRAL MUSEUM,
NAGPUR, C.P.
April 11, 1932.

E. A. D'ABREU, F.Z.S.

[The Common Monitor (*Varanus monitor*) was discovered breeding on Island of Salsette by Mr. C. McCann in June. He took eleven eggs. Newly hatched monitors are very common on the island at the commencement of the rains.—EDS.]

XXVII.—THE FAMILY OF A RUSSELL'S VIPER, OR CHAIN VIPER, *VIPERA RUSSELLII*.

On the 25th April 1929 two adult specimens of the Russell's Viper were brought to me by a local snake charmer who assured me that he secured them at a place a few miles from Malir Railway Station (about 18 miles from Karachi) in a vegetable garden not far from a pool of water.

The snakes were in good condition, very active, with their fangs intact and showed no signs of having been in captivity for any length of time. I had therefore little or no reason to disbelieve his statement besides the man knew that snake collecting was my hobby and was hardly likely to deceive me.

I placed the two specimens in a specially constructed case with glass sides, protected by wire netting, a perforated zinc top, and doors at the two narrow ends. A slot not more than 3/8th of an inch wide ran across the middle of the box, at the top, through which a board could be inserted to isolate the snakes when the case required cleaning.

For the first fortnight or three weeks they refused food but later fed readily on dead rats and sparrows.

The male (ascertained later when he died) desquamated on the 8th June but the female showed no signs of casting her skin for nearly a year, when she died.

The female which was two or three inches longer than the male and much thicker appeared to me to be gravid so I watched her closely. On the 12th July, or 79 days after I obtained the snakes, I found, on going into the verandah at about 8 o'clock in the morning, that the glass case was swarming with young snakes three or four on top of the case and several on the floor at the base of the stand on which the case rested. I managed with difficulty to secure these and put them back. I immediately closed the slot at the top of the case through which they escaped and set about removing the young ones one by one and placing them in a large glass jar. There were thirty-three in all, twenty-seven fully developed and six immature and dead with portions of the egg adhering to them. Whether any got away before I saw them I am unable to say but it is quite possible as there was nothing to prevent them.

The baby snakes were very active and when let loose on the floor struck readily at anything placed in their way.

I chloroformed them the same day in order to ascertain their measurements, which are as follows:—

14,	length	10¼	inches	... 250.35 mm.
8	,,	9¾	,,	... 247.65 mm.
5	,,	9¼	,,	... 234.95 mm.

The markings on the young were very distinct but the ground colour differed from that of the parent snake being slaty grey above and light cream below.

KARACHI. A. A. L. FLYNN, V.D., C.M.Z.S.

[The Russell's Viper is one of our most prolific snakes—only surpassed in this character by the Python and the Checkered Water Snake (*T. piscator*). A captive female in the Society's rooms presented us with 62 young. The eggs within the body of the parent are enveloped with a soft white leathery skin which one sees in the eggs of snakes. In the latter stages of pregnancy this investment is converted into a delicate transparent membrane through which the embryo snake can be seen distinctly. This membrane is ruptured within the body of the mother. The young are produced free but sometimes some of the young are discharged in their sacs. These if not speedily liberated perish. Often unfertilized eggs are discharged, these will be found to retain their leathery coverings. The young of the Russell's Viper are highly poisonous at birth. The Russell's Viper, according to the distribution given by Wall, (*Poisonous Terrestrial Snakes*, 4th. edn.) has not been recorded previously from Southern Sind.—EDS.]

XXVIII.—SNAKES IN AHMEDNAGAR.

The snakes mentioned in this paper were collected or sent to or seen by me whilst I was Civil Surgeon here. The collection covers a period of twenty-six months from December 1929 to end of January 1932. The total number of Snakes seen was 249; 148 from Nagar City and Cantonment limits and 101 from the Nagar District, mostly collected at the Taluka Dispensaries. They were identified here and doubtful specimens were sent to the Bombay Natural History Society for identification or confirmation. The various species were the following:—

1. The Common Blind Snake (*Typhlops braminius*)—11. Of these six were found in my Bungalow.

2. The Red Earth-Boa (*Eryx conicus*)—10.

3. The Black Earth-Boa (*Eryx johnii*)—2.

There were 4 live pythons (*Python molurus*) seen with snake-men who had come from outside. One of these was 9 feet 4 inches long. 3 were caught in Beed District, Nizam's territory, and one near Khandwa, C.P.

4. Checkered Water-Snake (*Tropidonotus piscator*)—2. Both these were from the district.

5. Buff-striped Keel-back (*Tropidonotus stolatus*)—2. Both specimens were found in Nagar Cantonment limits.

6. Green Keel-back (*Macropistodon plumbicolor*)—32. Another common snake.

7. Common Wolf Snake (*Lycodon aulicus*)—46. A very common snake.

8. Dhaman (*Zamenis mucosus*)—12. Ten were from City limits, one being 8 ft. long.

9. Fasciolated Dhaman (*Zamenis fasciolatus*)—7. Five were from Nagar Cantonment and City limits—one was 4 ft. 8 in.

long—a record one (reported in the Bombay Natural History Society's Journal Vol. xxv, No. 4). Another was 4 ft. 6 in. long.

10. Spotted Dhaman (*Zamenis gracilis*)—8. Two live specimens of the Royal Dhaman (*Zamenis diadema*) were seen with a snakeman who brought them from near Jodhpur (Rajputana).

11. Trinket Snake (*Coluber helena*)—34. This snake is considered to be seen about 1,500 ft. altitude. Nagar is about 2,000 ft. above sea level.

12. Brown Tree-Snake (*Dipsadomorphus trigonatus*)—34. A snake as common as *Lycodon aulicus*, in the vicinity of Nagar itself.

13. Common Kurki Snake (*Oligodon subgriseus*)—1. From the district.

14. Banded Kukri Snake (*Simotes arnensis*)—3. From the district.

15. Three-striped Coral Snake (*Callophis trimaculatus*)—2. One of these small coral snakes was found near Cursetjee's shop and one in 2/4th Grenadiers' Mess.

16. The Common Krait (*Bungarus cæruleus*)—11. Three of these were sent from the district and two of them had bitten boys and were responsible for two deaths. These were reported in the *Indian Medical Gazette* of May 1931 and February 1932. Eight were found in Nagar Cantonment limits. None were secured from the City. The distribution in the Cantonments was also restricted —all of these being found in the south side of Bhingar Nullah. One of these which was brought alive to me had bitten a snake catcher on 24-10-1931 and killed him inspite of the bitten person using what he believed to be his own specific medicine. The case is reported by me in the *Indian Medical Gazette* of February 1932.

17. The Cobra (*Naia tripudians*)—13. Twelve from Nagar itself—one of these killed near Cursetjee's shop was 5 ft. 9 ins. long. In addition, nine were seen with snakemen come from outside; three from Nizam's State, one from Satara District, one from Kandwa, C.P., and four from Jodhpur, Rajputana. All Nagar specimens were binocellate with series of dark ventral plates under the neck. All others were also binocellate except one specimen from Nizam's territory which was non-ocellate (*var. cæca*). It was 5 ft. 11 ins. long.

18. The Russell's Viper (*Vipera russelli*)—5. All were from the district, none from the City and Cantonment limits. Two of these were baby ones about 11 inches long and one adult one from Rahuri was 4 ft. 8 in.

19. The Phoorsa (*Echis carinata*)—4. All these were from one place only in the district, Newasa, and were found in the local Dispensary compound.

BOMBAY. K. G. GHARPUREY,
April 27, 1932. LT.-COL., I.M.S.,
Civil Surgeon, Ahmedabad, Deccan,
Bombay Presidency.

XXIX.—CASES OF SNAKE BITE.[1]

Since I have been stationed at Ahmednagar, I have come across the following cases of snake bite, six at Ahmednagar itself and two from the district and one from outside, during the last eighteen months. This is not a 'snakey' district, as during the last six years an average of only thirty deaths due to snake bite have been reported annually, in a district with a population of nearly one million and an area of 6,630 square miles.

The following are notes of the cases:—

Case 1. A woman came to the Civil Hospital, Ahmednagar, at 5-30 p.m. on 30th April, 1930, with a killed snake that was dried up. This snake had bitten her in the morning at about 6 a.m. on the right forearm about 2 inches above the wrist. The whole forearm was red and swollen as far as the elbow. She had applied 'Oriental Balm' to the arm. There were no after-effects, the swelling gradually going down.

Result:—Recovery.

The snake was a Trinket Snake (*Coluber helena*)—3 feet 6 inches long—non-poisonous.

Case 2.—Case reported in the *Indian Medical Gazette* of March 1931 of a person bitten in Dhulia, West Khandesh, on 27th July, 1930.

Result:—Recovery.

The snake was *Echis carinata* or Phoorsa—poisonous, pitless viper.

Case 3.—A boy, of about 8 years, bitten by a Common Krait (*Bungarus cœruleus*). Case reported in the *Indian Medical Gazette*, May 1931, p. 266.

Result:—Death.

Case 4.—A man from the city of Ahmednagar came at 10 a.m. on 24th June, 1931, to the Civil Hospital, Ahmednagar, complaining that when he woke up in the morning he found his face swollen and that he found a small snake near his pillow. His face was slightly red and swollen.

The snake he brought was alive and was a baby *Lycodon aulicus* or the Common Wolf Snake, 8 inches long—non-poisonous.

Result:—Recovery.

Case 5.—A cobra bit one of the hospital staff on 8th July, 1931; the case was reported in the *Indian Medical Gazette* of October 1931.

Snake—Binocellate Cobra (*Naia tripudians*)—poisonous. Antivenene used.

Result:—Recovery.

Case 6.—A boy, of about 7 years, who had just recovered from cholera was found vomiting and unconscious on his bed in the morning at a place named Kolhar Khurd about 36 miles from here on 14th August, 1931. On removing him from his bed a small live snake was found under him. There were many scratches on the boy's back. The boy was seen by Dr. Shiveshwarkar, Assistant Director of Public Health, who was on tour. He brought the killed snake to me. It was a baby common krait—*Bungarus cæruleus*—12 inches long—poisonous.

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[1] (These notes were printed in the *Indian Medical Gazette*, Vol. lxvii, Feb. 1932).

Result:—The boy died at about 12 noon, the same day.

Case 7.—A snake bit a woman below the ankle in the evening of 20th August, 1931, and she came to the hospital at 8 p.m. with the killed snake.

The snake was a Red Earth Boa (*Eryx conicus*)—16 inches long—non-poisonous. The bite had no effect on the woman.

Result:—Recovery.

Case 8.—Three live snakes were brought to me at the hospital caught in a grain godown on 8th October, 1931. They were all Trinket Snakes (*Coluber helena*) non-poisonous. After being let out from a tin in which they were kept, they were identified, captured again and put into the tin. While he was capturing them, one of these bit the catcher on the right index finger on the dorsal surface about ¼ inch behind the nail. There were no puncture holes but there were four scratches, two long ones about ¼ inch long and ¼ inch distant and two small ones on the wrist-side of these two scratches.

The person who was bitten was the same one as in case 5 who was bitten by a cobra before. He was a bit nervous after the bite and complained of slight pain for two hours. Permanganate was applied to the scratches to soothe him. He complained of itching about the eyes, beginning 15 minutes after the bite and lasting for about two hours.

There were no after-effects.

Result:—Recovery.

Case 9.—A snake catcher named Mahaboob Khan lived in a mosque in Bhingar, a suburb within Ahmednagar cantonment limits. He was a reputed snake catcher and used to make money from this job. He came to me on 31st July, 1930, with a big dhaman snake about 8 feet long; he said he had a medicine which he used in cases of snake bite, invariably successfully, and wished me to try it. On talking with him for some time, it was found that he was a practical man of the world and had worked as a stable boy, groom, syce and a rider at the racing stables in Bombay and Poona. I got the impression from his previous history that he lived more by his common sense, wits, and manual dexterity in catching snakes, than by the efficacy of any snake cures. The medicine, he told me, was the powdered fruit of *Michelia champaca* (white variety)—N.O.—*Magnoliaceae*—given in goat's milk. Only an occasional tree of this species gives fruit. So the fruit is rare. This Mahaboob was bitten by a snake he caught on 23rd October, 1931, at about 5 p.m. in trying to extract its teeth. He collapsed and became cold, and probably died by 9 p.m. His neighbours came to my bungalow at 12 midnight reporting his condition and said his body was cold. My assistant went there with anticenene at about 1 a.m. but the man had been dead four hours before. The deceased had taken by the mouth his own medicine after having been bitten.

The snake was brought alive to me and it was a full-grown common krait—*Bungarus cæruleus*—poisonous—3 ft. 5½ ins. long. The punctures on the man were two and were on the dorsal aspect of the left middle finger on either side of the first inter-phalangial joint about 1½ inches distant. As the mouth of the krait was not wide enough for the distance between the fangs on the two sides to be over an inch, it is presumed that the man put the bent joint of his left middle finger in the snake's mouth to keep it open and used his right hand to pull out or break the snake's teeth with tweezers.

Result:—Death.

K. G. GHARPUREY,
LT.-COL., I.M.S.,
Civil Surgeon, Ahmednagar,
Deccan, Bombay Presidency.

BOMBAY.
April 27, 1932.

XXX.—A FISH PEST OF FIELDS ALONG THE COROMANDEL COAST [*OPHICHTHYS BORO*, Hb.][1].

(*With a plate*).

Many are aware of the injury occasionally caused to paddy fields by crabs in different tracts, especially in some of the delta areas of the Coromandel coast but it might be a surprise, to at least some, to be told that there is a fish which has been noted as injurious in some of these tracts. This creature (which is known as *Anaikuthupambu* in Tamil, and the damage it causes *Ramasuli* in Telugu) is an elongated flattish creature with the general appearance of a snake and believed to be a water snake. The animal is really a fish and belongs to the group of fishes called 'Eels'. This creature generally inhabits the estuaries and tidal streams along the coast and is often found to travel inland in the channels and streams during ebb tide. Though up to the present it has been noted as a pest only in the coast of South Arcot and in the Godaveri delta, the creature has a wide distribution and is one of the commonest species of eels found along our coasts and estuaries.

The nature of the damage done by this creature does not, as in the case of most other pests, consist in any direct injury by the creature feeding on the plants or causing them any mechanical injury, but it is an indirect harm caused by numbers of these eels burrowing into and making wide passages across the bunds, thus connecting the paddy fields containing fresh water on one side and the adjacent salt water channels or tidal streams on the other.

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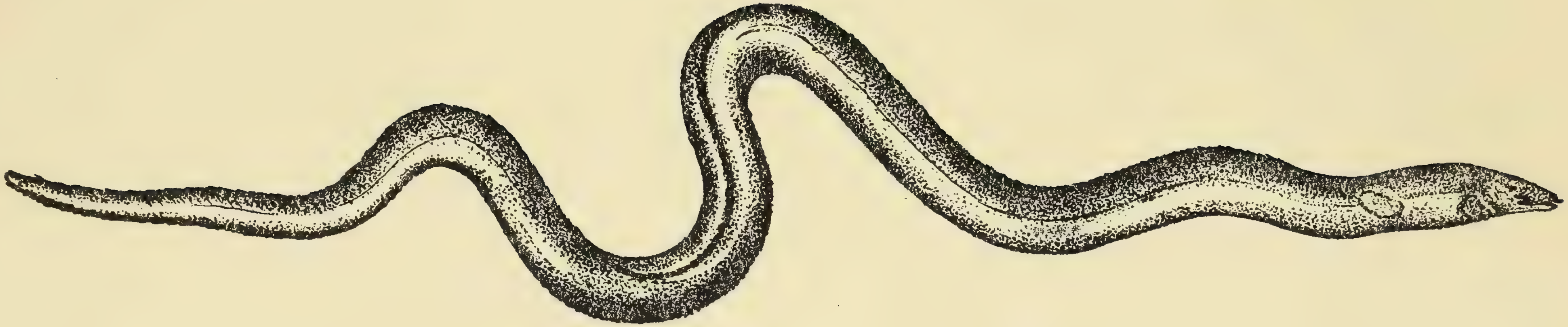
[1] Paper read at the Indian Science Congress, Bangalore, January 1932.



A Burrowing Eel (*Ophichthys boro*).

This causes the salt water from these latter to enter the paddy fields and affect the growth of the plants; due to the ill effects of salt water, the plants wither and often die. The damage is thus described by a cultivator near Chidambaram:—'The snake bores through the flat bund of the Uppanar channel which is eleven feet wide—gradually the bund weakens in several places causing sudden breaches allowing the salt water into the paddy fields and polluting the fresh water on account of which the plants wither; lands to the extent of 500 acres are thus affected by the overflow of salt water through holes and passages made by the snakes called *Anaikuthupambu.*' Though it was only recently that this creature was reported as a pest in paddy fields, it was known to the writer as a pest in a different role as early as 1918. In March, 1918, a report was received from the Commissioner of Salt and Abkari, Board of Revenue, Madras, to the effect that some of the salt pans and condensers in Ganjam and Godaveri were being damaged by crabs and a burrowing creature, causing injury known as *Ramasuli* in Telugu. The writer had the privilege of visiting these tracts to investigate the reported damage in April, 1918, and it was then that this *Ramasuli* was found to be an eel and evidently the same as the *Anaikuthupambu.* The injury caused to the salt pans was due to the burrows of the eels through the bunds of the pans, in which salt water is collected and allowed to evaporate. The burrows thus made by eels and crabs allowed the water to run out through them, leaving the pans dry before the salt had crystalised. Thus this eel has been noted as a pest of salt pans and paddy fields. Though the agent is the same in both cases the damage done is different in the two cases. In the one it is prevention of salt formation while in the other it is saline injury!

This eel has recently been definitely named with the help of the Director of Fisheries, Madras, as *Ophichthys* (*Pisoodonophis*) *boro* and is recorded as a common species of eel with a very wide distribution along the Indian coasts. Very little is, however, known of the habits of the creature except that it burrows in mud and underground wet areas. The very name *Anaikuthupambu* in Tamil means 'embankment cutting snake'. In the salt pans of Cocanada this creature is known as *Rama* and the hole made is known as *Ramasuli.* The fish is very rarely seen, though common, and is said to come up with the tide and descend into the soft mud when the tide goes down, making a long winding hole in its trail. The soil along the coast in such tracts is very fine and soft forming a favourable haunt of this mud fish. It has not been definitely investigated why it burrows into the bunds. It is probable that it may be for egg-laying but this remains to be confirmed. One cultivator suggests that the creature enters the paddy fields to catch insects.

The remedial measures against this creature whether in salt pans or paddy fields are similar, *viz.*, the prevention of the creature burrowing into the dividing bunds. The radical measure will be to strengthen these bunds and in the case of irrigation channels and salt water creeks the Public Works Department has to see that the dividing boundaries are strengthened to prevent the pest making passages into cultivated fields. The other alternatives consist in the trapping and destruction of the creature in different ways. The writer has already made suggestions on similar lines in 1918 to the Board of Revenue in his report on the investigations made on their behalf. Now that the creature has begun to affect paddy fields also it is necessary to adopt these and other measures to control the ravages of this pest. The Director of Fisheries suggests that the creature may be trapped in numbers by burying below water level near the bunds large pots filled with rotten meat or fish and that the eels which will be trapped in these pots may be collected next morning and killed as in the case of common fresh water eels. Such and other trials in the way of preventing this injury by eels have to be tried before any definite suggestions are made. At the same time the habits of the creature have also to be studied in various aspects—when it breeds, at what seasons it is found in numbers and in what parts it is a pest, etc. The main idea of this paper is to bring to the notice of all agriculturists and economic Zoologists the existence of such a novel pest so that any one of us who may have chances to come across this fish in future may be able to add to our knowledge regarding the same.

The following notes on this creature are taken from Day's Fauna volume on Indian Fishes:—

The fish is found in the seas and estuaries of India and Malaya, ascending large rivers to far above tidal reach. It grows to a length of two feet and in colour it is greenish olive above with numerous minute blackish spots, becoming greenish white below. Respiration in this fish is curious: it can not only respire as usual under water but can also breathe the air taken through the mouth. The natives in parts of Bengal imagine that this fish proceeds from the ear of a porpoise! Sir William Elliot says that in some parts of Madras these eels caught from salt water creeks are eaten as a remedy for weakness or pains in the loins.

MADRAS. T. V. RAMAKRISHNA AYYAR,
June, 1932. B.A., Ph.D., F.Z.S.,
Madras Agricultural Department.

XXXI.—THE FOOD SUPPLY OF TROUT IN THE NILGIRIS.

One of the chief problems in connection with trout culture in the Nilgiris is the question of food supply. The greater part of this is provided by crabs, but it is desirable to increase as far as possible the supply of surface food in order to get the fish to rise freely. To effect this numbers of flowering trees and shrubs have been planted out along the river banks, watercress beds were formed, and a strip of grass about 20 yards broad along each bank conserved from all burning; it is in connection with this last question that I am addressing you. Will it improve insect life in the grass to leave it unburnt or would it be better to burn annually? If unburnt the grass in a year or two becomes coarse and dry and about knee-high, whereas of course if burnt annually new grass springs up with the first showers. So far as I have observed the insect life here consists of several varieties of 'flies' and midges (types of Mayfly, March brown, etc.), of grasshoppers of different sizes, and of beetles varying from the small green irridescent kind to the huge red-brown cockchafer several inches long. The flies are presumably water-bred; I have noticed small grasshoppers to be particularly plentiful in freshly burnt areas where the young grass is sprouting, but as I know nothing about the life history of either grasshoppers or beetles, I am uncertain whether young or longer grass is better suited to the various stages of their existence. I am afraid that the data offered is not much for you to go on, but perhaps you could advise as regards burning whether it would be better to continue to give complete fire protection as at present or to burn annually; or as a compromise to burn alternate banks every other year. Any suggestions you can offer will be most acceptable.

Laxmipuram, E. G. PHYTHIAN-ADAMS,
Mysore. Major, I.A., *Retd.*
May 22, 1932.

[As a preliminary it would be necessary at first to investigate the sources and the nature of the food upon which the trout in the streams mainly subsist before it is possible to discover whether the burning or the conserving of the grass would be beneficial to their food supply. This implies the examination of the stomach contents of a number of specimens at different seasons of the year. Once the natural source of the food was ascertained and the insects identified it would be possible from the knowledge of their habits to so improve conditions in the neighbourhood of the streams as to attract the creatures which provide food for the trout. We are publishing the above note in the hope that those with experience of trout culture in the country may be able to suggest initial methods whereby the conditions in the Niligiri streams may be improved.—Eds.].

XXXII.—METHODS OF DEALING WITH PLAGUES OF ANTS.

We receive from time to time enquiries about effective means of getting rid of ants on lawns, gardens and in bungalows. The question has been recently the subject of correspondence in the *Field*. Various remedies are suggested. A correspondent gives the following method of dealing with ants on lawns, etc, 'Wherever there is to be seen a hole in the ground through which ants are coming and going invert a good sized flowerpot over the opening. After a week or so it will be found that they have transferred their elaborate system of galleries from under the ground into the pot. When on looking through the hole in the pot it is seen that the nest is almost at this height, slip a piece of card under the mouth of the pot, then sink the whole in a tub of water when the ants in all stages of their existence will quickly be drowned. This method is particularly useful to adopt on a lawn where it is often impossible to deal effectively with an ants' nest without damage to the grass'.

Remedies suggested for plagues of ants in houses are the sprinkling of powdered sulphur in places where ants foregather or move in ordered procession—an effective alternative to sulphur suggested by another writer is powdered cinnamon.

A remedy found effective on a South African fruit orchard is a quantity of bran sweetened with golden syrup thinned down with a little water—the whole making a crumbly moist mass—to this add a quantity of Paris Green (arsenic) and place the mixture where the ants can get at it. As a safeguard against the poisoned bran being eaten by dogs, birds, etc., it is suggested that the bran should be put into a closed box into which plenty of holes have been punched. Empty cigarette tins make good containers, the holes should be plentiful and pierced low down on the sides of the tin so that the ants can get at the bait easily. For use in food cupboards, a correspondent suggests sprinkling the shelves with dry borax powder covered with white paper. A variant of the borax remedy is equal parts of borax powder and white sugar mixed with water to the consistency of cream and placed in saucers near the place where the ants congregate thickest. This, says the writer, attracts them in legions for a week and then they gradually thin out and do not appear again.

BOMBAY. EDITORS.
August 1, 1932.

XXXIII.—BEHAVIOUR OF THE RED TREE ANT, (*ŒCOPHYLA SMARAGDINA*).

Early one morning in May my attention was attracted by a number of Red Tree Ants (*Œcophyla smaragdina*) clustered about the paws of a hare which had been left to dry on the terrace of our bungalow at Khandala. Overhanging the terrace was a guava tree which sheltered a number of these ants but no nest. One saw them moving about the stems and twigs. Knowing from experience how aggressive these ants usually are, I decided to test them and put my finger down a few inches away from the assemblage. Very soon one or two of the insects moving about on the outskirts of the crowd came up to my finger. I expected to to be bitten immediately but to my surprise the ants did nothing but move round my finger. Rather surprised at this very unusual behaviour, I moved my finger closer to the ants, it was at once inspected by a few more without any active hostile demonstrations. I went further and put my finger right into the middle of the cluster. There was a swarming mass of these red ants around it but not one of them attempted to bite me—my small son aged 6 was an interested spectator of this experiment. Later I heard him dare two small boys to put their fingers in among the red ants and, on their declining, promptly did so and was none the worse for it.

In the light of many experiences with these ants, and their readiness to attack, their behaviour on this occasion seems strange. It is possible that this aggressiveness is exhibited mainly in defence of their nests—but then anyone who has sat down on the ground where red ants are foraging will attest that the creatures bite actively and readily even when not defending their strongholds.

BOMBAY. S. H. PRATER,
August 1, 1932. M.L.C., C.M.Z.S.

XXXIV.—A SCORPION (*BUTHUS*) FEEDING ON A GALEOD SPIDER (*GALEODES AGILIS*, Poc.)

Galeodes agilis is very common in the Chippabari Inspection Bungalow (Abu Hills, Rajputana). It rightly deserves its specific name, *agilis*, for it is extremely active and can cover ground very fast. This appears to me to be true when the spider is on the ground, but when the proposition of climbing presents itself it is certainly not very agile and from this I conclude that it is truly a ground dweller and only takes to climbing to escape an enemy. In habit, it appears to be entirely nocturnal.

One morning on turning over my holdall which was lying on the floor, I discovered a large scorpion (*Buthus sp.*), finishing the remains of a large Galeod spider. The soft abdomen and portion of the thorax had been completely eaten. The legs were discarded.

At first sight it would appear somewhat strange how such a spider should fall a victim to a scorpion, comparatively, a slow moving creature. This, however, may be explained by the habit of the spider itself. Though very rapid in its movements, this spider rushes about blindly and possibly it relies on its speed to catch up with anything that forms its normal prey. Speed appears to be its mainstay in securing its food and is also probably a factor resulting in its death.

BOMBAY NATURAL HISTORY SOCIETY, C. McCANN,
BOMBAY. *Assistant Curator.*
May 4, 1932.

XXXV.—A CURE FOR TAPEWORM.

In July 1930 I was admitted into hospital with severe abdominal pains, particularly on the right side from just below the ribs to almost the groin. My condition was at that time attributed to the after-effects of dysentery, combined with malaria and ænemia. I was treated accordingly. No one suspected the presence of tapeworm. With the first intravenous injection of quinine I passed about three yards of tapeworm. No sooner was this discovered I was treated with Male Fern (*Filix-mas*) with a negative result. This failing another preparation (of which I do not remember the name) was administered. This likewise had no effect and no further appearance of the worm was noticed.

My condition remained much the same. I complained of a distinct lump just below the ribs on the right side which moved about and in moving caused me considerable pain. Eventually I was X-rayed but the radiograph showed nothing. Seeing there was nothing to be done and that I was weakening daily, I requested the Medical Officer to permit me to leave the hospital, which he agreed to on condition that I went to the hills, for at least two months. My weight at the time of leaving hospital was 8st. (normal about 10st. 4 lbs.). In the first eighteen days up in the hills my weight increased rapidly with just ordinary food supplemented with Ostomalt. After this stage progress was gradual till I reached almost normal weight. During this time my stomach was very uncomfortable particularly after meals and I was advised to take Milk of Magnesia. This gave me temporary relief. Towards the end of the two months my weight began to drop once more.

In the meantime I received a letter from a friend of mine advising me to take a decoction from the roots of the Pomegranate (*Punica granatum, L.*) after fasting for three days. But, as I was not troubled much at the moment I did not attempt it. About three days before I was due back at work I discovered segments in the stools, so I determined to try the effectiveness of the Pomegranate root and on my return to town took the matter in hand. For the purpose I obtained about ¾lb. of fresh root and boiled it as directed in Dymock's *Pharmacographia Indica*, vol. ii, p. 45, but I did not follow the instructions to the letter. The roots, that I had secured, I boiled in about 4 pints of water till they were almost reduced to half the quantity and appeared like strong tea. This I drew off and allowed to cool. The roots were then crushed and reboiled in a like quantity of water and after the water had again boiled down to about half it was added to the first lot, thereby giving me about 4 pints.

Before commencing the treatment, I took 1 ounce of Magnesium Sulphate in the morning followed by a hot cup of tea after which I kept a rigid fast for three days. On the third day I commenced with the decoction early in the morning and by noon had taken 2½ pints followed by another dose of Magnesium Sulphate. About 1 p.m. the worm was ejected in a large tangled mass. Relief was almost immediate—the lump from under my ribs disappeared. On examination it turned out that the head remained inside. There was nothing to be done for the moment as I was not anxious to repeat the fast. My condition improved considerably and I felt a new man. Two months later to the day I was worried once more by my guest. I repeated the experiment adding this time 45 drops of Carbon Tetrachloride after taking the last dose of Pomegranate decoction. The result was a negative one. As I did not succeed this time, and no further segments appeared, I let the matter lie till the worm showed itself again.

Again two months to the date, the worm made its appearance. In sheer desperation to get rid of the beast I altered the treatment slightly. A friend of mine suggested that I should try chloroform this time, added to the Pomegranate treatment. In order to make sure of a thoroughly empty stomach I commenced by the administration of a strong soap and water enema in the evening before retiring, followed up next morning by one ounce of Magnesium Sulphate. On the top of this I commenced the Pomegranate decoction and continued it throughout the day till I had consumed 2½ pints. The same evening at seven o'clock I took 15 drops of pure chloroform in half a wine glass of water. By 8-30 p.m. the complete worm was expelled.

The Pomegranate decoction gives one a slightly sickly feeling, but it is not unbearable, while the chloroform just made me a little unsteady. By the next morning all the effects had worn off.

As the last mentioned treatment was so effective I recommended it to a friend of mine whom I knew had been suffering from the same complaint for over 16 years. He had tried every possible thing and had failed every time. However, eventually he followed my advice, but being a bigger man than myself, he increased the doses in each case. He took 3 pints of the decoction and 25 drops of chloroform and eventually two ounces of Magnesium Sulphate. The result was good. He passed 50 ounces of tapeworm. On examination of the mass it was found that there were 38 heads! In both the cases the tapeworms concerned were the Beef-Tapeworm (*Tænia saginata* Goeze).

It may be mentioned here that during the treatment tea alone was taken at intervals throughout the day, a full meal after the expulsion of the worm.

Before I end this note I give below the precise method of the treatment:—

(1) At night a strong enema before retiring.

(2) Early next morning 1 oz. Magnesium Sulphate.

(3) 2½ pints of Pomegranate decoction from *fresh* roots, taken at intervals during the day.

(4) 15 drops of pure Chloroform at seven in the evening (or quantity prescribed by the doctor according to the constitution of the patient).

(5) Half an hour after the chloroform repeat dose of Mag. Sulph. to clear bowels of decoction.

Now a word with regard to the effect of *Filix-mas*. I am given to understand that this drug is very efficacious in Europe in cases of tapeworm. If this be the case the only reason for its failure in India is possibly due to the fact that the drug when used, is old, and in consequence has lost its potency. As it is stocked by chemists over long periods it in all probability degenerates.

Bombay Natural History Society,
Bombay.
November 1, 1931.

C. McCANN, F.L.S.,
Assistant Curator.

XXXVI.—SOME SEAGRASSES FROM THE PRESIDENCY OF BOMBAY.

While collecting seaweeds at several places the writer has collected a few flowering plants often associated with certain algae. In view of the following remarks by Dr. F. Borgesen some information about seagrasses will be of some interest. He writes: 'At Bombay I had expected to find a rich vegetation of seagrasses at the shores, but in this respect I was disappointed as I have not found any.' So writes Dr. Borgesen in one of his papers. This fact is to some extent corroborated by Cooke in his flora.

Notwithstanding the writer has succeeded in collecting the following plants:—

1. *Halophila ovalis* Hook. (*Hydrocharitaceae.*)
2. *Halophila decipiens* Ostf. (*Hydrocharitaceae.*)

The first species which was collected at Malvan and Port Okha in the month of March, 1929, was identified at Kew through Rev. Fr. E. Blatter. The second species was identified by Prof. Ostenfield at Copenhagen according to Dr. Borgesen. Both the species were abundant and grew mixed up with the species of *Caulerpa.* It was collected at Bombay in the month of January 1926.

3. *Cymodoceae sp.* probably *isoëtifolia* Asch. (*Potamogetonaceae.*)

This plant covered a fairly large area of hard calcareous soil at Port Okha in March; the same place was formerly covered by *Codium elongatum* Ag. in January 1929.

4. *Ruppia rostellata* Koch. (*Naiadaceae.*)

This plant formed the main part of vegetation (in March 1927 and 1928) of a mudflat near Santa Cruz which was flooded by seawater at high tide. It was mixed up with *Chara succincta.*

Rev. Fr. E. Blatter has kindly identified these plants.

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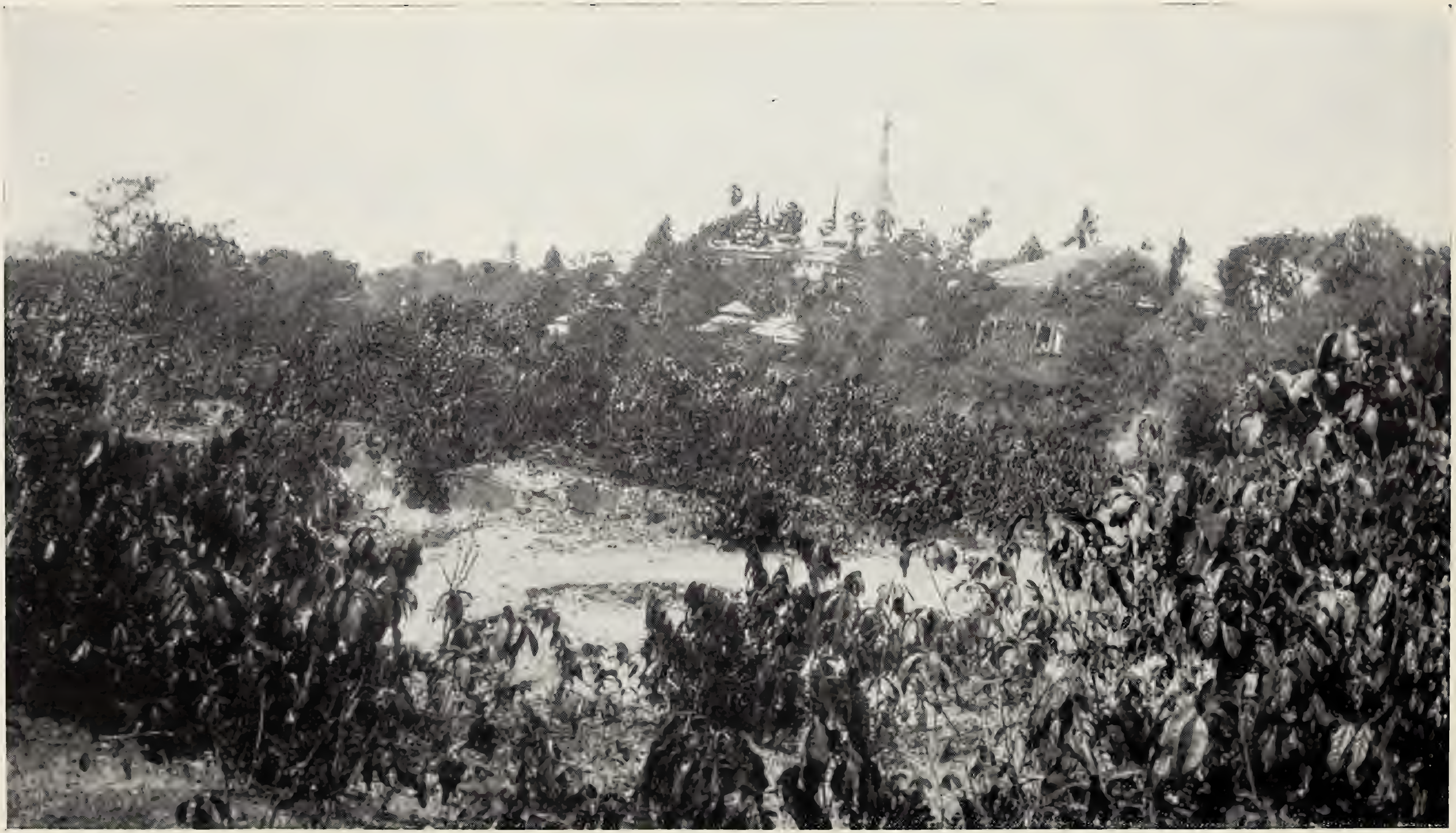
Wilson College,
Bombay, 7.

S. C. DIXIT,
M.SC., M.A.



Top of Moulmein hill with open mixed association of *Connarus paniculatus* in the foreground and *Bambusa polymorpha* in the background. Buddhist pagodas are partly hidden in Bamboo and Palm groves,

XXXVII.—GLIMPSES OF THE VEGETATION OF SOUTH BURMA.

(*With three plates*).

Any one travelling in the Tropical Rain Forests of South Burma will find a striking similarity of these forests to those of Chittagong Hill Tracts and Aracan Sea Coasts. In fact, the same type of forests gradually runs down along the Aracan Sea Coast and finally extends to the Malay Peninsula through Mergui and Tenasserim differing only in their luxuriance and density and particularly in their evergreen and mixed nature due to variation in climatic and edaphic factors. Towards Chittagong and Aracan sides the vegetation is more of a mixed deciduous and evergreen type and further down in Mergui and Tenasserim it takes more of an evergreen character. In swampy places along the sea coast, river sides and estuaries, these forests merge into the mangrove formation. In most of the flooded and low land areas *Nipa fruticans* and *Acanthus ilicifolius* form in some places an association. In comparatively drier and higher parts *Avicennia officinalis*, *Excoecaria Agallocha*, *Rhizophora*, *Bruguiera*, *Ceriops*, *Sonneratia acida*, *Carapa obovata* and others are frequently found encroaching upon the hill forests of lower elevations.

Thus following the vegetation all along this area one finds some of the common representative species. During secondary formation there is the same tendency of the plants developing into a tropical rain forest in which Bamboos and Canes claim supremacy, although, in some places *Blumea balsamifera* gains in the beginning an upper hand but soon it is overtopped by bamboos. Thus in some of the most frequented areas, as noticed on the Moulmein hills of the town proper, *Bambusa polymorpha* is a dominant species growing in dense thickets. The other shrubby species—such as, *Connarus paniculatus*, *Congea tomentosa*, *Melastoma malabathricum* form a mixed association in more open areas. Along the slopes—*Sterculia villosa*, *Chaetocarpus castanocarpus*, *Ficus* species and other trees and shrubs indicate that they are the members of the Tropical Rain Forests.

Proceeding further down as I entered the Kyeinchaung Forest areas of the Cinchona Reserve, an uncharted country in Tenasserim, Mergui District, I came across the characteristic dense mass of vegetation of the virgin Tropical Rain Forests covering shady valleys and slopes of low ranges of hills extending towards Siam in the north and Malay in the south. Here lofty trees shoot up from an impenetrable crowded mass of Bamboo brakes and Cane brakes.

In moist and darker portions of the forests beautiful palms are found scattered here and there, and in some places groups of *Licuala peltata*, *Zalacca Wallichiana*, *Cycas Rumphii* and other herbaceous Scitamineae species are not infrequently met with.

Thus, the vegetation of these primeval forests may be subdivided into four strata. The highest belt consists of tall species of *Dipterocarpus*, *Ficus*, *Dillenia*, *Stereospermum*, *Sterculia*, *Lagerstroemia*, *Parashorea* and others forming a canopy over the next tier of mixed Bamboo and Cane brakes. This central zone of mixed Bamboo brakes interlocked with rattan is chiefly composed of several species of bamboos such as *Bambusa arundinacea*, *Bambusa polymorpha*, *Gigantochloa albo-ciliata*, *Dendrocalamus strictus* and others.

Associated with these bamboos and canes are also found smaller trees, shrubs and tall herbaceous species such as *Barringtonia acutangula*, *Grewia Microcos*, *Streblus asper*, *Randia species*, *Croton species*, *Ixora species* and also a few species of palms noted above. This stratum again gradually dwindles down to the low shrubby and herbaceous members, namely, *Strobilanthes sp.*, *Jasminum sp.*, *Coffea bengalensis* and smaller plants of *Gnetum sp.* (The young leaves of *Gnetum edule* are a favourite vegetable diet of the Burmans.) Finally, this zone of herbaceous association gradually ends in the floor vegetation of low diffused herbs and trailers which in some places appear as mosaic carpets on the ground. Pure grass mats are extremely rare inside these forests. Tall lianes, scandent shrubs and climbers, such as *Bauhinia sp.*, *Butea superba*, *Vitis sp.*, *Entada scandens*, *Zizyphus œnoplia*, *Mucuna sp.*, *Ipomaea sp.*, and others are found intertwined with Bamboo brakes or overhanging like festoons from taller trees. Along the banks of the Kyeinchaung river the spreading shrubs of *Homonoia riparia* are commonly met with in the forest. Epiphytic orchids, such as *Dendrobium densiflorum*, *Dendrobium Pierardi* with their long drooping bunches of beautiful flowers, and numerous plants of the most common epiphytic fern—*Asplenium nidus* with its full grandeur, adorn the branches and stems of trees often covered with thick pads of mosses. *Rhaphidophora pertusa* and *Pothos scandens* often climb up to a considerable height on the trunk of sturdy trees. The thicker leaves of the herbs and shrubs in the interior of the forests have their margins fringed with mossy outgrowths and are often studded with numerous epiphyllous lichens. Of these mention may specially be made of a magnificent specimen of nest epiphyte—*Platycerium grande*, (the staghorn fern) wellknown for its large pocket leaves and pendulous dichotomous foliage leaves. This plant was seen in the suburbs of Mergui on a stout high branch of a lofty tree of *Durio zibethinus*, one of the most favourite fruit trees of South Burma. This interesting fern which is reported here for the first time from Mergui, South Burma, is a native of Malay Peninsula, (as recorded by Schimper) and it might have found its way up in Lower Burma as well.

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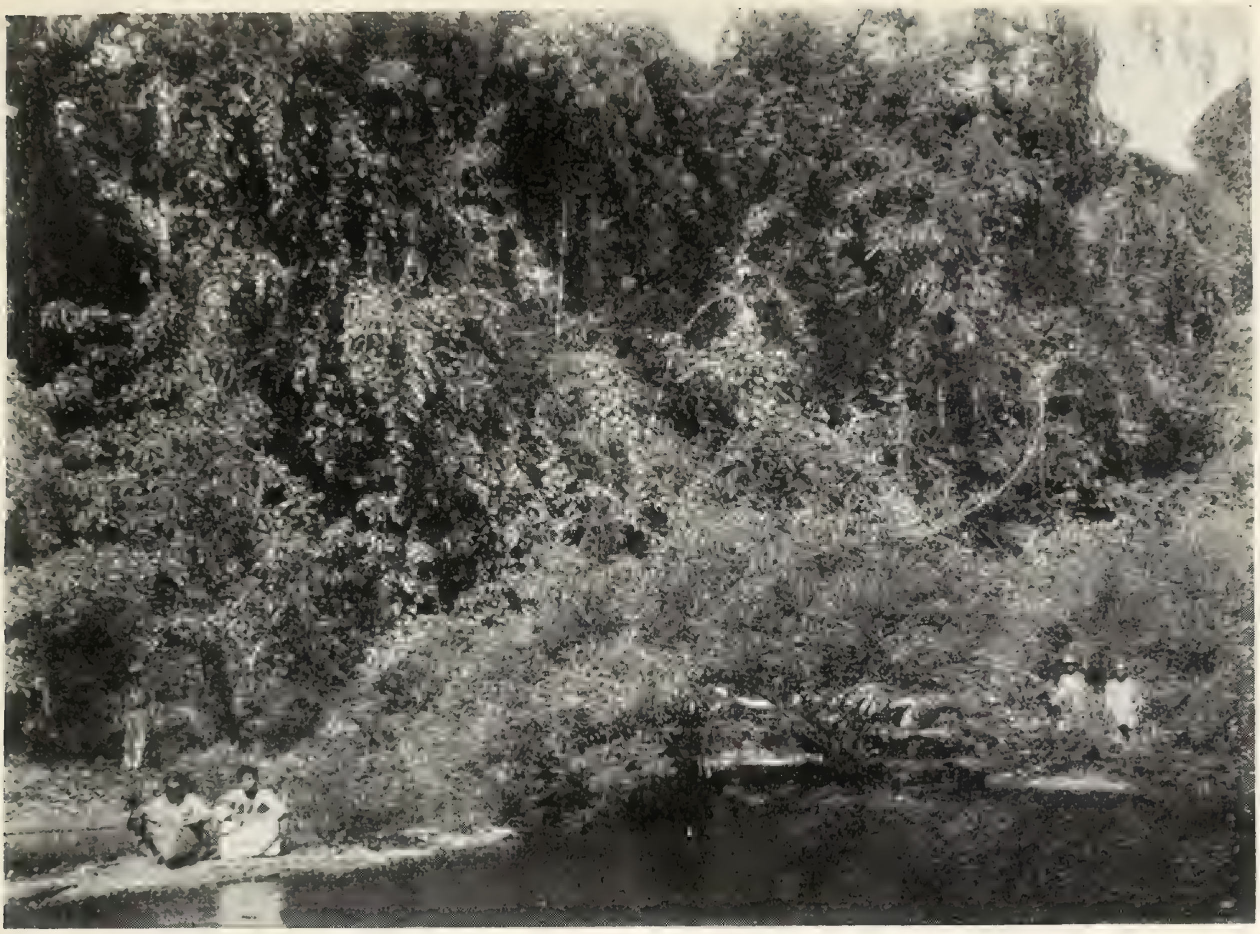
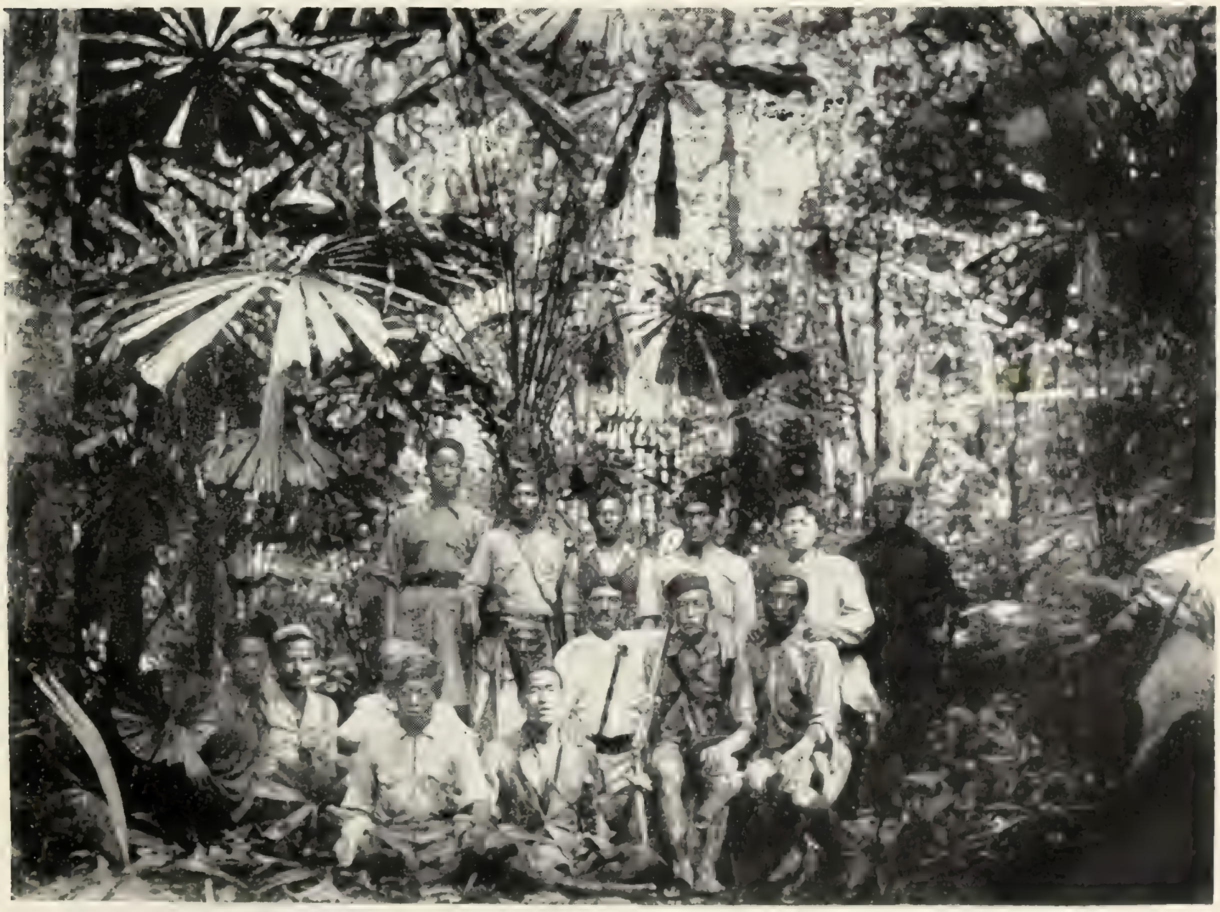
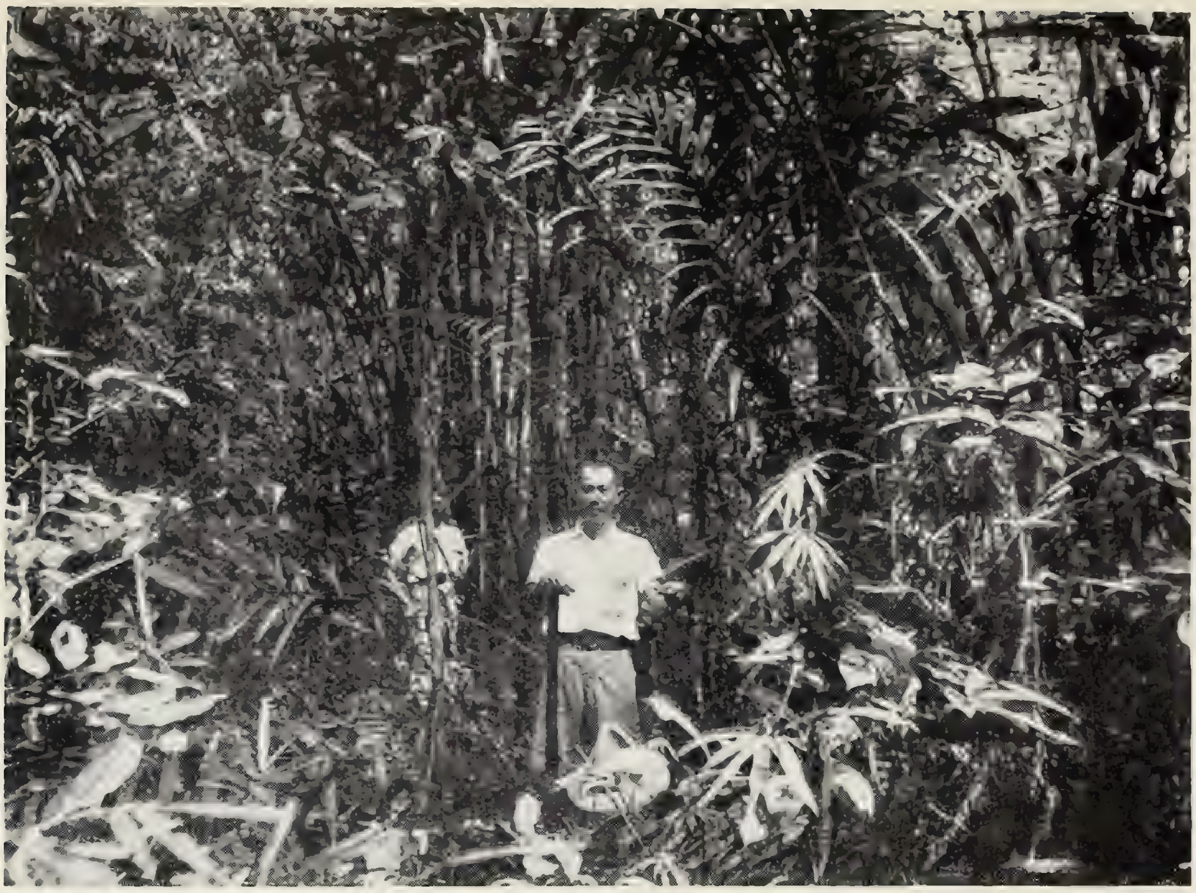


A general view of the forests by the side of Upper Kyeinchaung river with overhanging climbers and drooping branches of *Baccaurea sapida*. In the fore ground is the spreading shrub of *Homonoia riparia*—the most common shrub along the bank of this river.



A group of *Licuala peltata* in the Kyeinchaung forest with the party accompanying the author in his botanical exploration.



Bamboo and Cane brakes in the interior of the virgin forest area of Miachaung.

Interior of a secondary formation in Tenasserim, showing Cane brakes with epiphytic *Asplenium nidus* and climbing *Rhaphidophora pertusa* on the moss-covered trunk of a tall tree.

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K. BISWAS, M.A.,
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XXXVIII.—SCENT IN RELATION TO FLOWER-COLOUR.

The study of scent in relation to flower-colour, has been followed during the last quarter of a century with increasing interest. Of particular interest and importance, however, is the linkage of blue flower-colour with scent. This combination is said to be exceedingly rare.

A resumé of the known species of scented flowers of blue colour, has been well drawn up by Hampton.[1] They are: *Meconopsis sp.* K. W. 5751 (observed by Kingdon Ward), *M. speciosa*, Prain, *M. latifolia*, Prain, *Primula cernua*, Franch. (observed by Kingdon Ward), *Gentiana ciliata*, Linn. (observed by Kerner; but Hampton is of the opinion that they are devoid of scent), *Tecophilea cyanocrocus*, Leyb., *Nymphaea stellata*, Willd. (observed by Hampton; but there are certain varieties of this species with white corolla), *Salvia patens*, Carv. and several members of the Borage family.

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[1] Hampton, *The Scent of Flowers and Leaves*, 1925.

It is thus evident that the paucity of scented flowers of pure blue, is very great indeed. Observations were made by the author in this direction on certain Indian flowering plants both indigenous and acclimatised. The results obtained are interesting in the way that they add eight species to the list of flowers having a combination of blue colour with scent. The species studied are enumerated as follows:—

Iris persica, Linn. (fam. *Iridaceae*): Commonly known as Persian Iris is a small bulbous plant and bears blue flowers of delightful fragrance.

Caryopteris Wallichiana, Schau. DC. *Prod.*, xi, 625 (*Clerodendron odoratum*, D. Don, *Prod. Fl. Nep.*, 102): This Verbenaceous member is a spreading shrub and produces pretty blue sweet-scented flowers in great abundance during February and March. It may, however, be pointed out that there is a variety of this species which produces only white flowers.

Angelonia grandiflora, C. Morr., *Ann. Soc. Hort. Gand*, iii, 1847 (fam. *Scrophulariaceae*): This herbaceous species keeps flowering all the year round. The flowers are blue having a strong scent suggesting pineapple.

Passiflora laurifolia, Linn. Sp. 956 (fam. *Passifloraceae*): is a climber and bears fine blue flowers that are fragrant.

Hydrolea zeylanica, Vahl. (fam. *Hydrophyllaceae*): is a water-plant quite common in Orissa ponds. Its flowers are blue and are at the same time fragrant.

Jacaranda mimosaefolia, Don. (=*J. ovalifolia*, R. Br.): this Bignoniaceous species is a native of Brazil and is a big-sized tree. Its blue flowers are very sweetly scented.

Brunfelsia latifolia, Benth., DC. *Prod.*, x, 199 (=*Franciscea latifolia*, Pohl, Pl. Bras. Ic. 3. t. 2): belongs to the family Solanaceae and is one of the most lovely of the garden plants. It flowers by the end of February. The fine flattened flowers are exquisitely fragrant but they subsequently lose their colour and turn white.

Brunfelsia Hopeana, Benth. (=*Franciscea uniflora*, Pohl., l.c. 2 t. 1): is a shrub which (from February to March) produces a great profusion of lovely blossom of pure blue or white flowers. Both the types of flowers emit a most agreeable perfume.

Botany Department,
Ravenshaw College, Patna University,
Cuttack, India.
July 4, 1932.

T. C. N. SINGH.

XXXIX.—VERNACULAR NAMES.

Your reviewer objects to the rendering of *Brinjara* in my 'Book of Man-eaters'. He will find *Banjara* in my 'History of the

Hyderabad Contingent', published by the Government of India in 1905; and objection has been taken to that transliteration.

It is scarcely necessary to say that, having a knowledge of the language concerned, and having been associated with these people, sometimes for prolonged periods, during more than thirty years, I am fully aware that the word is Banjara in the vernacular. But I wrote Brinjara deliberately. It is the common English rendering, sanctioned by long custom, just as most of us, possibly including your reviewer, write *Brahmin*.

If we are pedantic we may find faults, real or imaginary, in most publications. A very common mistake, made by R. W. B. and others, is spelling sambar with an 'h' in the middle; let us hope the mistake is not repeated in pronunciation!

R. G. BURTON,

March 22, 1932. *Brigadier-General.*

PROCEEDINGS OF THE MEETING HELD ON 14TH. JULY 1932.

A Meeting of Members of the Bombay Natural History Society was held at the Prince of Wales' Museum on Thursday the 14th. July at 6 p.m. Khan Bahadur C. M. Cursetjee presided.

Sir Reginald Spence, Kt., the Honorary Secretary, announced the election of 16 new members since the last meeting held on the 31st. March. In all 40 new members had joined since the commencement of the year—this was an improvement on the corresponding figures of the previous year—but there was room for further improvement—he hoped that members would do what lay in their power to keep up the membership of the Society and so enable it to carry on the work it was still doing in spite of difficult condition which prevailed everywhere.

NEW AQUARIUM FOR BOMBAY.

There are many schemes which are awaiting better times for development. Among these is a Marine Aquarium for Bombay.

Sir Reginald stated that he has harboured this project, among many others, for a long time, and he hoped that before he left India it would bear fruit. He had managed to secure from the Government sympathetic consideration for a free site for an Aquarium on the new reclamation. What he wanted now was Rs. 50,000 to put up and equip a building—not a large sum—but one which was not easy to come by in these times of depression. The prospect was not bright, but he did not give up hope that the Marine Aquarium would become at no distant future an accomplished fact.

JUBILEE NEXT YEAR.

Sir Reginald reminded the members that 1933 would see the 50th. anniversary of the foundation of the Society and expressed the hope that conditions in Bombay and the world in general would enable the occasion to be celebrated fittingly.

EXPEDITION TO KHERI.

Mr. McCann, Assistant Curator of the Society, then gave an interesting lecture illustrated with lantern slides on the recent expedition to Kheri, Garhwal, on the Nepal border. The Expedition was undertaken on behalf of the Field Museum, Chicago.

American Museums have in recent years concentrated a great deal of attention upon India and this country has been the scene of various expeditions organised by American institutions with a view to collecting specimens representative of the Indian fauna and flora. The New York Museum recently opened its hall of Indian Mammals which contains perhaps the most beautiful series of groups, illustrating the great game animals of the Indian Empire. The material collected for these groups was obtained mainly through Mr. Vernay, a vice-patron and generous benefactor of the Society.

The Field Museum of Chicago is now going to have its Indian Hall. The specimens which are to be exhibited in the Hall, will represent, like those in New York, the larger game animals of our country. They were collected some years ago during an expedition undertaken by the late President Roosevelt's two sons. The animals are now to be set up and exhibited in groups in their natural surroundings.

The Society, which helped the New York Museum in completing its work, was asked to co-operate in collecting the material and accessories required for the Field Museum groups. It is not necessary to explain what these museum groups are. We have several groups in the galleries of the Prince of Wales' Museum which are as fine examples of the type of work as is to be seen anywhere in the world. Had we the space, and what is equally important the funds, we in Bombay could have as fine an exhibit of Indian Mammals as is now to be seen in a foreign country.

The purpose of the modern Museum group is to reveal the facts of life as one may read them in the book of nature. Art and science combine to make the lesson pleasing and instructive. In the modern group the animal is seen not as a dead classified museum specimen but is seen in the environment in which it lives and has its being. To serve its purpose the group must be true to life. It must correctly represent the animal and illustrate some phase of its life. It must with equal truth reproduce the surroundings in which the animal lives. The only way to do this is to study at first hand both the animal and its habitat. This in brief is the nature of the work which the expedition set out to do.

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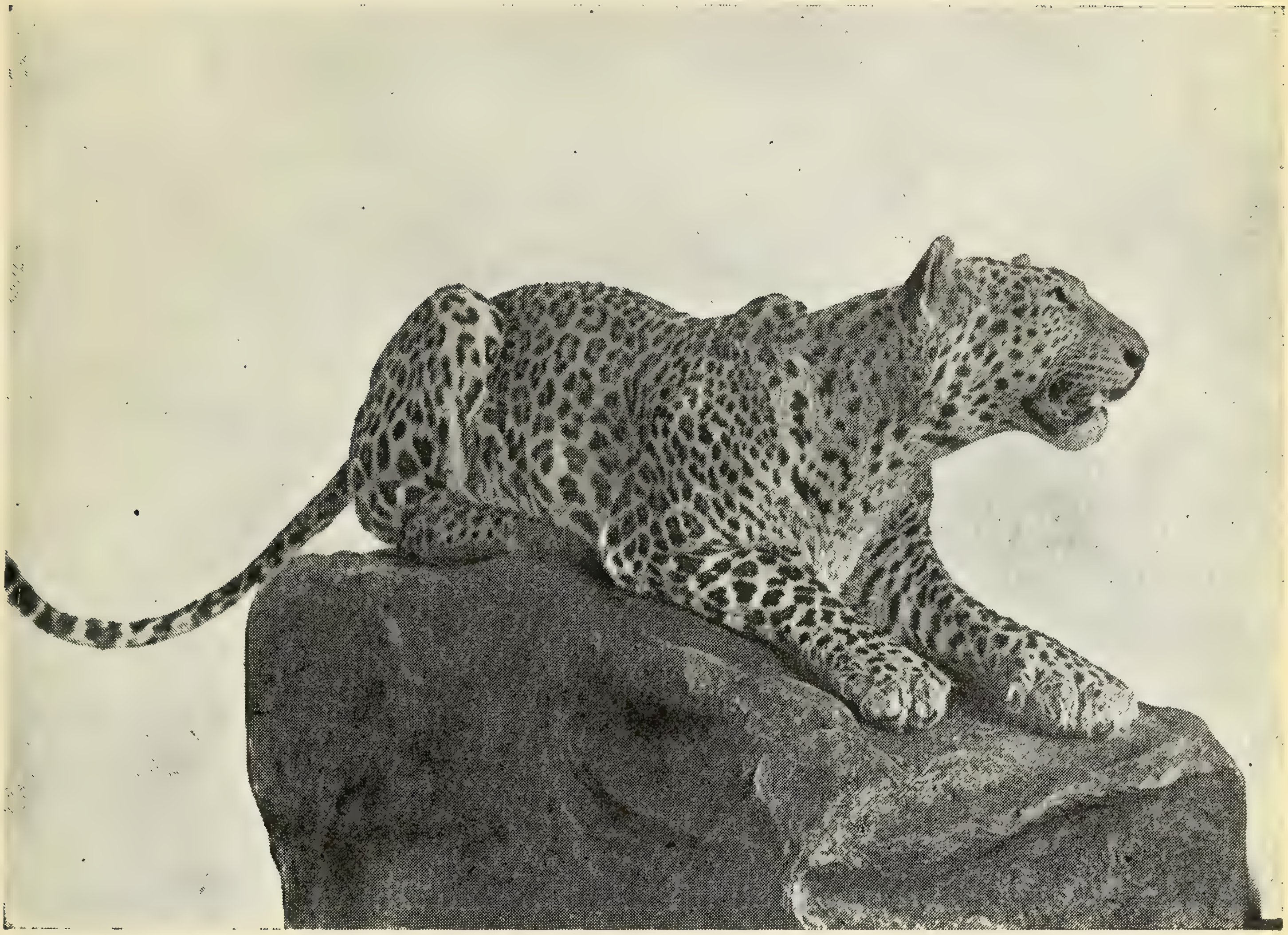

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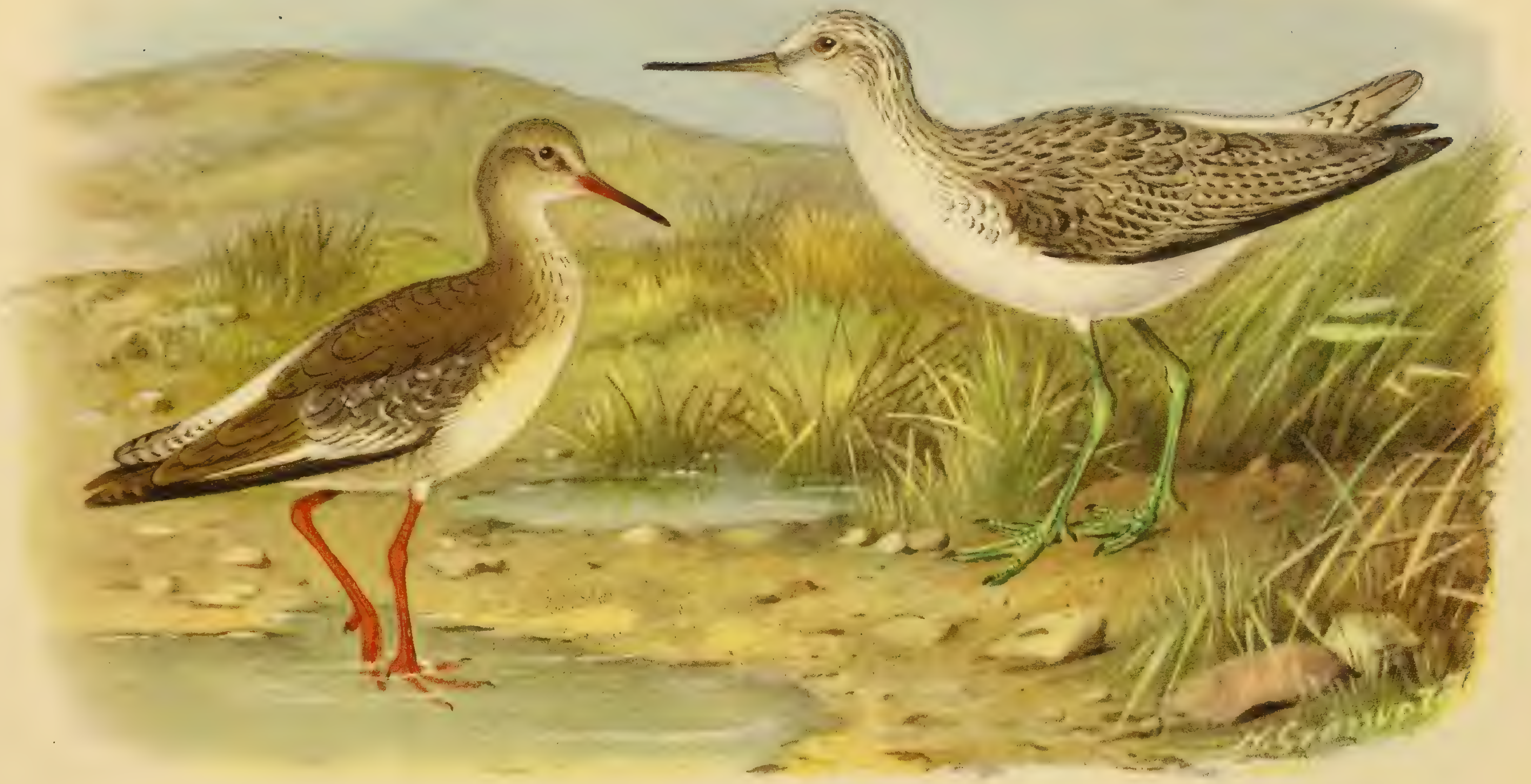

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THE REDSHANK ⅓.
Tringa totanus totanus.

THE GREENSHANK ⅓.
Glottis nebularia.

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THE GAME BIRDS OF THE INDIAN EMPIRE.

BY

E. C. STUART BAKER, C.I.E., F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

VOL. V.

THE WADERS AND OTHER SEMI-SPORTING BIRDS.

PART XIX.

(*With a coloured plate*).

(*Continued from page 12 of this volume*).

GENUS: TRINGA (*contd.*).

TRINGA TOTANUS.

Scolopax totanus Linn., Syst. Nat., 10th. ed., i, p. 145 (1758).

Type-locality.—Sweden.

In 1926 Meinertzhagen, reviewing this species (Bull., B.O.C., xlvi, March 29, 1926) came to the conclusion that the race from Ladak named *eurhinus* by Oberholser was not separable from the typical form and he then proceeded to give a name, *Tringa totanus terrignotæ*, to a form, based on the type from the Kuku Nor. An examination of the material in the British Museum and of some specimens lent me by Messrs. Whistler and Osmaston convince me that Meinertzhagen is right and that the Ladak and Tibet breeding-birds cannot be separated from one another though they are both very different from his bird from the Kuku Nor. We have therefore this extraordinary distribution arising. The European bird seems to work eastwards through Siberia, keeping north, another stream works south into the Himalayas, whilst between the two there is sandwiched another race breeding in the Altai, Kuku Nor, Tianschan and probably a considerable area in Central Asia.

I can see no difference in size between Ladakan and Tibetan birds and those from Europe, so *eurhinus* becomes a synonym of *totanus*. Fifty specimens of the former have wings from 152 to 164 mm., and fifty of the latter wings from 150 to 168 mm.; the culmens respectively measure 42 to 47 and 40 to 49 mm.

I should, however, state that some Naturalists still consider that the Eastern race is separable.

Key to Subspecies.

A.	Much darker above and much less suffused with rufous	*T. t. totanus.*
B.	Much paler above, with the upper plumage strongly suffused with rufous	*T. t. terrignotæ.*

TRINGA TOTANUS TOTANUS.

The Redshank.

Scolopax totanus Linn., Syst. Nat., 10th ed., i, p. 145 (1758) (Sweden).

Totanus calidris.—Blanf. & Oates, iv, p. 264 (part).

Tringa totanus totanus.—Stuart Baker, Fauna of B. I., vi, p. 221 (1929).

Vernacular Names.—*Chota Batan* (Hind.); *Mali-kotan* (Tam.); *Maha-matuwa* (Cing.).

Description.—*In Summer* upper plumage dark brown, the feathers of the crown and neck edged with fulvous, the inner secondaries and scapulars with bars of black and notches of fulvous; wing-coverts much barred black and rufescent white; lower back and rump white; upper tail-coverts white, barred with brown; tail barred pale rufous and brown, the lateral tail-feathers white and brown; primaries dark brown, the first with a white shaft, inner primaries mottled with white on the inner webs and tips; outer secondaries pure white, the latter mottled with brown on the inner webs; chin and throat white; sides of head, neck, breast and flanks white streaked with brown, varying much in extent; centre of abdomen and axillaries pure white; under tail-coverts white streaked with blackish.

Colours of soft parts.—Iris brown; bill black, reddish on the basal third; legs and feet orange-red, claws black.

Measurements.—Wing 150 to 168 mm., rarely 137 to 150 mm., probably young birds; tail 69 to 85 mm.; tarsus about 45 to 52 mm.; culmen 40 to 49 mm.

In Winter the black markings and fulvous spots on the upper part disappear and the general tint is more grey, less brown; the underparts have the streaks much smaller and restricted to the sides of the neck, lower fore-neck and breast; the forehead is white and the sides of the head and neck much less heavily streaked.

Young birds are more rufous above, the fulvous spots on the scapulars etc. more marked and the flanks are more banded with black.

Nestling.—Above rufous-buff, more fulvous on the sides of the head; well-marked black lines from forehead to crown, two lateral coronal bands meeting behind crown, through the eye from lores to the side of the neck; dark central and dorsal streaks; two dark lines on wings, one round the flanks and uropygium.

Distribution.—Throughout Europe, Northern Asia, Asia Minor, etc. to the Himalayas as far East as Setchuan. In Winter it migrates south to South Africa and South Asia, India, Burma, China, Philippines, etc.

Nidification.—The Redshank is supposed to breed from Europe into northern Asia and throughout the Himalayas from Kashmir to Setchuan but exactly where it meets the Eastern Redshank, if separated, is at present very doubtful. There is a form breeding somewhere in Central Asia, which has been named by Meinertzhagen *terignotæ*, but the nest and eggs of this bird do not appear to have been found and its exact breeding haunts are not known. Recently also *T. t. eurhinus*, an eastern breeding form of Redshank named by Oberholser but not accepted by myself, has been resuscitated and if recognisable, would be the form breeding in Ladak and Tibet. Ludlow, again, found them breeding in Eastern Turkestan but Kinnear has identified these birds as typically Common Redshank.

In Europe, the Redshank breeds during April and May though in the higher latitudes a great many birds breed well on into June, whilst in the more southern countries, birds which breed early in April often have a second brood in late June and I have found eggs myself in August. The latest recorded date which I have is the 23rd. of that month in Norfolk. The site selected for the nest is most often the wide marsh lands bordering the sea but they have also been found breeding in meadows of lush grass, in swamps and by little moorland pools far inland. Typically, however, they are certainly shore breeders. As a rule I do not think they like very rank vegetation in which to make their nests, though I have often found them placed in very dense tangles of the thick coarse grass known in the Eastern counties as 'maram grass', probably, but their favourite position is where the grass thins out considerably on the tops of ridges and sandhills of the foreshore. Occasionally I have taken them from tiny clumps of maram or fine grass standing quite alone and, when once found, such nests always strike one as being very conspicuous; at the same time, unless one is intent on finding the nest it is extraordinary how it can be passed by without being noticed. Sometimes these birds breed more or less in company. On one occasion I remember, Dr. Coltart and I obtained twelve nests from one field, all of which were built in one corner of it and probably none were more than fifty yards from their nearest neighbour. The morning in question was cold and wet, with a thick driving mist and, for the most part, the birds sat so close that they rose at our feet and the nests were very easy to find but, on the other hand, so thick was the mist that if they rose only a few yards ahead it was quite impossible to locate the spot from which they rose and I think we missed several other nests because of this. Another occasion I found five nests of this bird in very thin maram grass along the crest of a long low sand hill, while there were also two other pairs who were breeding in the thicker stuff at the foot of the hills. As a rule the nests are very well hidden and it is necessary to part the grass before one can see the nest and eggs, but they are given away by the curious little whirl of grass which forms the entrance to the nest. This is, or seems to be, invariably curled round with a curious twist, leaving a tiny mouse-hole in the centre which expands sufficiently to allow ingress and egress to the sitting bird. In the Himalayas, if our bird is the same, it breeds —according to Osmaston—in rushes and grass in swamps. He took two nests each containing four very hardset eggs near Shushal in Ladak at 14,200 feet in the first week of July. Other nests taken by Ward in Ladak were found early in June. A certain number of other nests and eggs were also collected for me by collectors in Tibet, these being taken at altitudes between 12 and 14,000 feet throughout June and once early in May.

The number of eggs laid is, of course, four but Crump took one nest with five, while occasionally three have been taken showing signs of incubation, though in every case these were probably second layings. The eggs are extremely handsome and vary very considerably. The ground colour may be anything from a pale yellowish or buffy stone colour to a rich ochre buff or buff, whilst in a few eggs the ground varies from pale greenish stone to an almost warm olive green, these latter, however, being quite exceptional. The markings vary even more than the ground colour. In many they consist of small specks, and spots of light to dark reddish distributed numerously over the whole surface of the egg. In others the blotches are very much larger and in these eggs are almost invariably much more numerous at the larger than at the smaller end. In a few eggs the blotches may measure as much as half an inch in diameter and generally when the blotches are very large, they are comparatively sparse and the eggs look very bold and handsome. The colour of these larger markings varies from rather dark purple brown to almost purple black and they are always more or less interspersed with smaller specks, spots and sometimes hieroglyphics of the same colour, with secondary markings of pale purple brown and grey. These secondary markings which occur in all eggs, whatever their markings may be, are never sufficiently pronounced to dominate the colour of the egg. Erythristic and cyanistic eggs occur but are very rare, but eggs the prevailing impression of which is brown are more often met with. Occasionally the blotches in more boldly marked eggs form rings or caps at the larger end. A hundred British eggs average 44.5×31.5 mm.; maxima *48.0*×32.0 mm. and 46.5×*33.1* mm.; minima *41.5*×*28.5* mm.

In shape the eggs are pyriform, very pointed at the smaller end, obtuse ordinary ovals being quite exceptional. The surface is close but not very fine and few eggs have any pronounced gloss.

Fifty eggs taken in Ladak, Turkestan, etc., average 44.0×30.5 mm.; maxima *48.0*×32.0 and 46.5×*33.1* mm.; minima *44.1*×*29.0* mm.

The period of incubation is, according to Witherby, twenty-three to twenty-six days. According to Witherby, also, the incubation is carried out principally by the hen, though the male bird has been killed off the eggs. In India it would appear that the cock bird sits quite as much as the hen.

Except in unusual circumstances, such as in the mist as described above, the birds are not close sitters and until the eggs are fairly advanced in incubation, it is difficult to approach without putting them up off at a considerable distance generally too far to enable one to locate the nests. So long as there are only eggs in the nests, they are rather shy birds but when the young are hatched they become very noisy and circle round any intruder, calling vociferously the whole time. As a rule, as soon as the young are hatched, however thin the grass is in which the nest may have been built, the chicks are invariably hurried into the nearest thick grass within a very few hours of their birth.

Habits.—The Redshank appears in the plains of India in vast numbers during September, leaving again in early April, at which time they may be seen in quite large flocks, in some cases possibly numbering hundreds. Many birds, however, appear quite early in August, whilst others do not leave until early in May, these latter being probably our Himalayan breeding birds. Once arrived in India, the flocks are split up into smaller numbers or into single birds and pairs but these reassemble before their departure, migration occurring principally in big flights. They may be found practically anywhere where there is sufficient water, whether this be marsh-land, rivers or streams. They have much the habits of many of the other small waders found throughout the cold weather in the plains but they are generally rather shy birds and do not allow of very close approach unless they are feeding with other waders who are less shy than themselves.

Their flight is powerful and direct, except when they are performing their nuptial display, which consists of a dipping flight carried out in circles. In flight, the white of the upper tail-coverts and tail are always conspicuous but during the nuptial flight the white tail is widely spread and the soft, fluffy white feathers of the rump seem to be extended so as to show more conspicuously than ever. They run well and swim lightly and easily on the water and I have more than once seen birds when disturbed from their nest, swim across small spaces of open dyke. The love-song is a beautiful trilling call, consisting of two notes rapidly repeated, sounding something like 'Trill-lee' and finishing up with a prolonged trill after which the bird alights on the ground. The ordinary call note is a shrill single whistle repeated twice and the alarm note is one which might almost be described as a squawking whistle very loud and harsh. Their food consists largely of water insects and their larvæ but they may be constantly seen picking small beetles and flies off the grass, while they also feed freely on small mollusca and crustacea, worms, etc., and one bird we disturbed in Norfolk dropped a tiny sand-eel which it had evidently just captured.

TRINGA TOTANUS TERRIGNOTÆ.

The Central Asian Redshank.

Totanus totanus terrignotæ Meinertzhagen, Bull. B.O.C., xlvi, p. 85 (March 1926) (Kuku Nor).

Totanus calidris.—Blanf. & Oates, iv, p. 264 (part).

Tringa totanus terrignotæ.—Stuart Baker, Fauna of B.I., vi, p. 215 (1929).

Vernacular Names.—As in the other races.

Description.—Much paler than the western race both in breeding and non-breeding plumage, whilst in the former it is much more marked and suffused with rufous on the mantle. It is also rather less heavily spotted below in some cases.

Colours of soft parts as in the preceding bird.

Measurements.—'Wings 145 (once), 148 (once), 151 to 169; exposed culmen 40 to 47 mm., true culmen 46 to 53 mm.' (*Meinertzhagen*).

Distribution.—Probably breeding in Tianschan, Kuku Nor and Turkestan. In Winter migrating south to India, Burma, Malay States and Archipelago and South China. Some birds from Aden and one from Sokotra are also referable to this race but some from Amur Bay and Mongolia seem to belong to the typical race, though somewhat intermediate.

Nidification unknown.

Habits.—This form of Redshank, of which the breeding haunts are at present unknown, only straggles on rare occasions into India on the West, but is a common visitor to Eastern India, Burma, and the Malay States. It is possible that this bird may eventually be found to be merely a phase—of either the Common Redshank or of the Eastern form, if that is accepted as distinct. The habits do in no way differ from those of the Common Redshank in voice, flight or anything else.

TRINGA ERYTHROPUS.

The Spotted or Dusky Redshank.

Scolopax erythropus Pallas, Vrœg's Cat. Coll. Adum., p. 6 (1764) (Holland).

Totanus fuscus.—Blanf. & Oates, iv, p. 245.

Tringa erythropus.—Stuart Baker, Fauna of B.I., vi, p. 223 (1929).

Vernacular Names.—*Batan, Gatni, Surma* (Hind.); *Yerra kal ulanka* (Tam.).

Description.—*Breeding plumage.*—Whole head, neck and lower parts sooty-black, the feathers of the head and neck very narrowly margined with white, those of the chin, lower breast and abdomen with broad white fringes; the mantle black with white edges to each feather and white spots on the sides of each web; many of the scapulars and inner secondaries more bronze-grey with broken black bars and white notches; lower back and rump white; upper tail-coverts barred black and white; tail with broader bars of black and more narrow bars of white; quills blackish, the shaft of the first primary white, the inner webs mottled with white.

Colours of soft parts.—As in the Redshank; legs dusky to orange-red.

Measurements.—Wing 152 to 168 mm., exceptional to 172 mm: tail 76 to 91 mm.; tarus 53 to 61 mm.; culmen, ♂ 53 to 59 mm., ♀ 56 to 65 mm.

In non-breeding plumage.—Above ashy-brown, the crown and neck immaculate, the upper back with tiny white fringes to each feather, broader on the scapulars and inner secondaries, which are notched with black and white; wing-coverts with broad white fringes; supercilium white; lores dark brown; sides of face and neck grey, lightly streaked darker, chin and throat white; foreneck pale ashy-brown; remainder of lower plumage white.

Nestling.—Very like that of the Common Redshank but upper down paler, almost buffy-white or greyish-white; underparts greyish-white tinged with buff, the down of the breast with dark bases which show up. Markings more brown, less black than in the preceding species.

Distribution.—Breeds throughout Arctic Europe and Asia, in Winter migrating south to Africa, India, Burma, China and the Malay States and Islands.

Nidification.—The Dusky Redshank breeds practically throughout Arctic Europe and Asia. Over the greater part of this area it is more common north than south of the Arctic Circle, but in Finland breeds as far south as Uleaborg, 65° latitude. We saw two or three pairs on the islands in the Gulf of Bothnia close to this town, which were evidently breeding, though we failed to find the nest, but at no great distance to the north of Tornea it was breeding in some numbers. It keeps for breeding purposes almost entirely to open marshland, though this may be at the level of the sea, or at some elevation on the swampy highlands of Lapland. The actual spot selected for the nest is generally fairly dry, and we never found nests placed amongst thin grass growing on the quaking swamp. Generally speaking, I do not think the nest could be distinguished in any way from that of the Common Redshank, although the eggs themselves are so strikingly different. The nest is just a depression in amongst the grass, with the latter curled round and beaten down so as to make a receptacle for the eggs. In most nests one finds a great many scraps of fine grass blades, but whether these are brought by the birds and worked into the nest, or whether they are merely strips from grass growing round it, it is difficult to say. Most of the nests I saw myself were in rather thin grass, not sufficiently thick effectually to screen the nest when once it was spotted. Occasionally, however, the nest was built in rather thicker grass and in these circumstances the grass at the entrance to the nest was twisted in the same little curl that one nearly always finds at the entrance to the nest of the Common Redshank. The bird itself gives little help in finding its nest and I have sometimes watched a pair for a long time which I knew to be breeding in the immediate vicinity, yet after half an hour's watching, they have generally cleared off without betraying their home. Occasionally a nest is found in swamps in among scattered and stunted birch and it is also said occasionally to breed among stunted firs. I have, however, myself seen no such nests. On the other hand, I have more than once had them pointed out to me on grass land on the outskirts of birch forest.

A few birds breed in the last week cf May in the southern portion of their breeding habitat but the great majority do not breed until the second week in June, from which time onwards eggs may be found until the end of the month and yet a few more in the first week or ten days in July. I do not think this Redshank ever breeds while the snow is actually on the ground, but it does so when deep drifts of it yet remain in the shady hollows or while the summits of the adjacent hills are still white-capped. Although we found them breeding in the same swamps as those frequented by Whimbrel and Bar-tailed Godwit, both of these had hard-set eggs and even young before the Dusky Redshank had thought of laying.

The eggs number four in a clutch, as with nearly all waders, and are easily distinguishable from any of the other waders with the exception perhaps of those of the Reeve, some of which they closely resemble. They are very handsome eggs and considered as a series, are more definitely green than any others that I know of. The ground colour varies from pale olive to a rather deep green; rarely olive buff or buff, with large and numerous blotches varying in depth of colour from a rather deep reddish brown to a brown that is almost black. Lines and scriggles very seldom are shown but I have a few eggs in my series upon which there are one or two of these lines of the same deep black brown as the larger blotches. The secondary or underlying markings are of a similar character and of lavender or greyish neutral tint. The browner or more buff type of egg very often closely approaches, as I have already said, the eggs of the Reeve. Jourdain gives the average of 100 eggs as—47.2×32.2 mm.; maxima *51.5*×33.0 mm. and 48.0×*34.0* mm.; minima *42.0*×32.5 mm. and 50.0×*30.0* mm. The texture is similar to that of the Common Redshank's eggs, but the surface is rather smoother and on the whole, with a more definite gloss. The shape, of course, is the usual pyriform.

The greater part of the incubation is carried on by the male and when first watching these birds, I have no doubt we missed some nests by paying too much attention to the hen bird and too little to the cock. The Finns also say that the male bird makes the nest, the hen contenting herself with just finishing off the curves and trimmings. Whether this is so or not, I cannot say.

Habits.—There is little to be said about the bird's habits in addition to what has already been stated about those of the Common Redshank. It is equally wild, equally noisy and equally hard to catch napping on the nest. Food and flight are the same as in that bird, and the voice too is very similar, though quite recognisable when one has heard the call a few times. One little habit I noticed of this bird seems to be peculiar to itself. We noticed that when breeding on grass-land alongside the sea, both birds had the habit of perching on tiny rocks where they would sometimes sit for nearly an hour at a time, calling to one another and occasionally shifting their position from one rock to another. Every now and then the bird would appear to busy itself, picking at something in the crevices of the rock and it is probable that they were feeding on some tiny crustacea. During the breeding season I think that possibly the Dusky Redshank keeps more continually in the open than does the Common Redshank, though this may be merely due to the thin grass the bird inhabits not concealing it so well as the long maram grasses that hide our English birds.

GENUS: GLOTTIS.

Glottis Koch, Syst. Zool., xlii, pp. 304 (1816).
Type, *Scolopax nebularia* Gunnerus.

It is with considerable doubt that I separate the two birds contained in *Glottis* from *Tringa.* Their very decidedly recurved bills seem, however, to form a character of sufficient importance to rank as generic. The difference in the webs between the outer and inner and middle toes in these two birds and the genus *Tringa* is so very slight that it is of no importance at all.

In *Glottis* the bill is upturned over the terminal half of its length; the grooves and nostrils are as in the genus *Tringa,* the web between the outer and middle toe is well developed, that between the inner and middle toe obsolete; the wing is long with the first primary longest; the other characters are as in *Tringa.*

The Summer plumage differs from the non-breeding plumage in being darker.

The genus is cosmopolitan.

Key to Species.

A. Larger; wing 179 to 200 mm.; tarsus much longer in comparison, measuring 59 to 65 mm. ... *G. nebularia.*

B. Smaller; wing 174 to 181 mm.; tarsus much shorter in comparison; 50 to 57 mm. ... ... *G. guttifer.*

GLOTTIS NEBULARIA.

The Greenshank.

Scolopax nebularia Gunnerus, Beskr. Finmark, Lapp., p. 251, note (1767) (Norway).

Totanus glottis.—Blanf. & Oates, iv, p. 266.

Glottis nebularia.—Stuart Baker, Fauna of B.I., vi, p. 225 (1929).

Vernacular Names.—*Tantanna, Timtimma* (Hind.); *Gotra* (Beng.); *Peria kotan* (Tam.); *Maha oliya* (Cing.).

Description—Breeding Plumage.—Head, neck and mantle blackish, the feathers of crown and neck edged longitudinally with white; back and scapulars with white edges forming lunar bars, the longer scapulars barred black and white on their edges, the inner secondaries notched with white; lower back and rump white; tail-coverts and tail white barred with light brown; central tail-feathers nearly all ashy-grey; wing-coverts brown, edged with whitish; primaries blackish, the outermost with a white shaft and the inner webs mottled with white and brownish on the basal two-thirds; the inner primaries and outer secondaries dark brown edged with whitish; sides of head, chin, throat, breast and flanks white, boldly streaked with blackish; centre of abdomen and vent unspotted white; under tail-coverts white with black streaks; under wing-coverts and axillaries white with light brown marks.

Colours of soft parts.—Iris brown; bill dark horny-brown or greenish-brown, blacker at the tip; legs yellowish-green or olive-green.

Measurements.—Wing 179 to 200 mm.; tail 88 to 100 mm.; tarsus about 59 to 65 mm.; culmen 51 (one) to 57 (one) mm.

In Winter the forehead is white; the whole plumage much more grey, the blackish centres being replaced by paler ashy-brown with dark shafts; the under plumage is pure white from chin to under tail-coverts.

Young birds are much browner, less grey in general tint, more spotted with whitish on both webs of the mantle-feathers and have the underparts more streaked with brown.

Nestling is marked like that of the Redshank but the upper parts are pale buffy-grey-white, more buff on the back and rump; the underparts are white, the fore-neck and sides of the head and neck suffused with grey.

Distribution.—Northern Europe and Asia, migrating south in Winter to Africa, India, Burma, Malaya, China and Australia. I can find no difference whatsoever in size or colour between the supposed eastern and western forms and consider *glottoides* merely a synonym of *nebularia.*

Nidification.—The Greenshank breeds throughout the greater part of the Sub-Arctic Region in Europe and Asia and within the Arctic Region roughly as far North as 68° latitude, as we found birds on the Fisher Peninsula on the White Sea all through June, although we did not actually find the nest. South it breeds in Scotland, Norway, and Sweden, Lapland and in North Central Russia, but in Asia its southern breeding limits have not yet been defined. In Scotland, while breeding, this bird keeps to the higher and wetter moorlands, breeding in the heather or on the grass, very often in the vicinity of some small lake or burn, but at times at considerable distance from any water. In Lapland, on several occasions we found the birds breeding in comparatively open pine and birch woods, selecting small open glades on wet and mossy ground. The nests are extraordinarily difficult to find and the birds very seldom give them away. They have, however, a habit of making them close to some landmark such as a big stone, a patch of ling or heather taller than that surrounding it, and if one bears this in mind, it is possible sometimes when a pair of these birds are seen, to find the nest by visiting every little prominence within sight. If this, however, fails, there is nothing else to be done but hide and try and watch the birds on to the nest, for it is practically hopeless ever to expect to put the bird off the nest by walking it up unless the eggs are on the point of hatching, or the young are already hatched. One clutch of eggs brought to us when we were in Lapland by a Lapp boy was said to have been taken from a nest inside stunted birch forest, where the trees grow closely together and there was no open space of any kind. This is I think unusual and all the pairs that we saw breeding, even in the interior of the forests, were haunting places where there were tiny lakes or other small open spaces. The nest is merely a depression in the ground lined with grass, bits of heather, or grass-stems, but in two instances out of every three, grass alone is used and even that consists principally of such as is beaten down in the formation of the nest. Sometimes the nest is carefully hidden by the surrounding vegetation, whatever that may be, at other times, especially when placed in thin grass, once found, it is very conspicuous. In Lapland we were surprised to find this wader breeding in company with the Whimbrel and Godwit on the great swamps which form nine-tenths of the whole of northern Lapland. Here they selected hummocks which rose more or less dry from the surrounding mud, and which were generally covered with a little thin grass and reindeer moss, the nest always being built in the former and consisting of nothing but a few twisted grass stems at the base of a tuft of grass longer and perhaps a little thicker than the rest.

The breeding season in the Southern part of its range commences in the middle of May and goes on to the middle of June, but further North few birds lay before the middle of June, whilst fresh eggs may be found well into July and I have eggs from Northern Finland dated the 29th. of that month. The eggs invariably number four and are of the typical pyriform shape of Waders' eggs. The ground colour varies considerably but as a rule from pale to a warm stone buff. At other times there is a distinct tinge of olive or olive green and very rarely pink. The markings vary to the same extent as the ground colour. In the majority of eggs they consist of fairly large blotches and spots of red-brown, chocolate, blood-red and almost black, with secondary markings similar in character to the primary, of lavender grey or in the pink eggs, of lavender pink. In other eggs the blotches are fewer in number and larger, whilst in yet others they diminish until they become large freckles. As a rule the markings, whatever their character, are distributed fairly numerously over the whole egg but more freely at the larger end. In a few eggs the markings are confined entirely to the larger end and I have one or two clutches in which the markings consist of a few very large bold blood-red and black blotches confined to the larger end. The texture is rather fine for the size of the egg and the surface often shows a fine gloss. Jourdain gives the average of a hundred eggs as—51.4 × 34.8 mm., maxima *59.8* × 37.7 mm., minima *54.8* × 35.4 mm. and 50.4 × *32.4* mm. The Finns tell me that incubation takes eighteen or nineteen days, and that the male bird practically does all the work of incubation, but that the female sits during the night. They also assert that the male bird is much the better parent when the young are hatched and is much more assiduous than the female in feeding them.

Habits.—The Greenshank, which for some reason Hume did not include in his Semi-Game Birds, arrives in India in early October, though a few birds may also be met with in the end of September. In North-West India and Sind they appear to arrive much earlier. Ticehurst (Ibis, 1924, p. 120) says they arrive much the same time as the Redshanks and of these latter he writes: 'It arrives in the last days of July or the first days of August, the adults in worn breeding dress being the first, as with other waders, and I have noted young birds by the 13th of August. Plenty remain throughout April, and probably most depart about the middle of May'.

Ticehurst also notes that some birds remain in Sind all the Summer and that he has seen them several times in June. In

Eastern India, I think, we may safely say that no birds Summer with us unless it is in the deltas of the Ganges and Brahmapootra where very few naturalists or observers have worked in the rains. The birds arrive in fairly large flocks, numbering sometimes fifty to a hundred individuals but they break up, on arrival, into small parties, seldom numbering a dozen birds, while often single birds and pairs may be met with. They keep almost entirely to wide open spaces but are just as much inland as seashore birds, so there are but few marshes, lakes or even small tanks with open shores upon which one or more pairs or single birds will not be seen.

They are not such restless birds as the smaller waders and one seldom sees them running constantly hither and thither in search of their food. They move about much more sedately, although they are capable of equal speed when necessary, especially when they are feeding on grasshoppers or active insects. For the most part, however, their food, with us, consists of crustacea, mollusca, worms, small reptiles and fish. They seem to be very fond of the small white worm which harbours among the roots of the winter rice and upon which Snipe so largely feed in India. I have shot Greenshank which seem to have fed on these exclusively and others which have mixed them with small mollusca and grasshoppers.

On the wing it is very fast and has such a twisting, doubling flight that it gives a very sporting shot; again it is not easy to approach within shot and, finally, it is almost as good to eat as the snipe and much larger so that it certainly deserves to rank as a semi-sporting bird.

With us it is a silent bird giving an occasional rather harsh 'whew' when other birds fly over it and giving the same call from time to time when flying. Its nuptial trill is rather like that of the Redshank, but not, I think, so shrill or piercing. It is difficult to describe in words the difference between the two calls, yet it is impossible to mistake the one for the other and I should call the Greenshank's a much less cheery note.

GLOTTIS GUTTIFER.

Armstrong's Sandpiper.

Totanus guttifer Nordman, Reise u. Erde (Erman) Natur. Atlas, p. 17 (1835) (Okhotsch); Blanf. and Oates, iv, p. 267.

Glottis guttifer.—Stuart Baker, Fauna of British India, vi, p. 226 (1929).

Vernacular Names.—None recorded.

Description—Breeding plumage.—'Differs from the Winter plumage in being blacker above and being spotted below with black; the crown blackish streaked with whitish edges to the feathers; the feathers of the back black; with spots of white to the edges of the feathers, more distinct on the scapulars and inner secondaries; upper tail-coverts and centre tail-feathers with slight indications of black spots; sides of face and sides of neck white, with triangular spots of black, larger on the latter; the ear-coverts slightly ashy-grey with obscure dusky streaks; under surface of body pure white, with a few small spots or streaks of black, irregularly scattered over the throat and breast, larger and more thickly distributed over the sides of the upper breast, and scarcely visible on the flanks; under wing-coverts and axillaries pure white' (*Mus. Henry Seebohm.*)

Colours of soft parts.—'Bill dusky, tipped black, yellow near the base; irides dark brown; legs and feet dull ochreous-yellow or greenish-ochreous' (*Armstrong*).

Measurements.—Wing, ♂ 178 mm., ♀ 174 to 181 mm.; tail 62 to 67 mm.; tarsus 45 to 47 mm.; culmen 50 to 57 mm.

In Winter.—The whole mantle is ashy-grey, each feather with dark shaft and whitish edges, much less conspicuous than in the preceding bird, while the white very soon becomes abraded and obsolete; the forehead, lores and sides of the head are white, the two latter distinctly spotted with black; crown and hind-neck ashy, the feathers white-edged and dark-shafted, the sides of the neck spotted with blackish; lower back, rump and upper tail-coverts white, the latter barred laterally with brown; tail white, with light brown contour marks; wings as in *Glottis nebularia*, under-parts pure white, the neck slightly spotted with dark brown; axillaries pure white.

Young birds resemble those of the Greenshank and are much more brown above than the adult, the feathers spotted and notched with buff; the throat and upper breast streaked and mottled with brown.

Distribution.—Apparently breeding in North-East Siberia and wandering South to North-East India, Burma and Hainan in Winter. Whether it breeds regularly or not in Tibet is not known. Eggs were taken by Steen in 1910 which he attributed to the Greenshank but which are exactly like an egg sent me with remains of a skin of Armstrong's Sandpiper, so that it is certainly a casual breeder in that country.

Nidification.—There is nothing recorded about the breeding of this bird except my own notes on some eggs found in Tibet. It is supposed to breed in Eastern Siberia, but eggs, authentic beyond all doubt have not yet been taken. In 1909 Capt. Steen took a single egg which he attributed to a Greenshank, the slightly upturned bill attracting his attention. In 1910 a full clutch of four eggs was taken from a nest on a ridge a little way from the lake (Hram-tso), with stunted grass and a little Tibetan gorse growing on it. This bird was shot and identified, as 'a Greenshank with Yellow legs!' but the skin was lost. Finally a single egg was sent me with remnants of a skin sufficient to show, by its bill and legs, that it was of the present species. This egg was 'taken from a neatly lined hollow in among some moss (? spagnum) and stunted grass and we could see the eggs when the bird moved off.'

The eggs are like large eggs of the Redshank or small ones of the Greenshank. The ground, in all, is a rather dull buff, in one more stone colour, and they are all rather handsomely blotched with deep reddish black or blood red. The blotches are large, some of them very large, interspersed with smaller blotches, spots and specks of the same colours; they are fairly numerous everywhere but more so at the larger than the smaller end. Their texture is rather coarse and the surface has no gloss; they are in shape of the usual peg-top, pointed types common to the waders.

Six eggs average 47.9 × 33.0 mm.; maxima *49.2* × *36.6* mm.; minima *46.4* × 34.3 mm. and 47.4×*31.5* mm.

The eggs were taken on the 16th. and 29th. May and 3rd. June respectively.

I should think it is very doubtful that this wader breeds regularly in Tibet as it has been recorded as a *passing* migrant both in Spring and Winter far north of Irkutsk.

Habits.—There is but little on record about this bird beyond Hume's notes in 'Game Birds' (Vol. iii, pp. 403-4) 'Dr. Armstrong writes to me "All that have been killed by me have been on extensive sand and mud flats exposed to the sea. I have never seen a *single* specimen on the numerous smaller flats forming the banks of the rivers and creeks in the vicinity of these localities, and where its near allies, the Greenland Redshanks are so abundant.

"I have never seen them solitary; they appear to seek their food sometimes in couples, but more usually in small parties of 3, 4, or 5 and are often associated with large flocks of Stints or Greenshanks with whom, however, they do not appear to mingle. They are much more wary than their companions, and it requires much caution to get within shooting distance of them. They are always the first to rise, so that in order to obtain specimens, I made it a rule to fire at the first birds to rise.

"In other respects their habits are similar to those of the other Shanks, Green, Red and Yellow; but I have often noticed that they liked to dabble with their bills in the mud or sand like ducks in a puddle of water.

"The stomachs of some I killed contained small mud-fish and crustacea, while those of others were crammed with larvæ and small mollusca" '.

This Sandpiper is probably not a rare visitor to Assam, Eastern Bengal and Burma though it is, when shot, generally overlooked. Again, as Armstrong says, it is so wild that of all the large waders of their tribe it is the least often shot and therefore appears to be more rare than it really is.

It occurs on passage, both Autumn and Spring in the Surma Valley and in the wider expanses of cultivation and swamps near the Brahmapootra. The few I have shot were generally in small parties feeding with other waders in the shallow mud on the edges of the swamps and not inside them. They were the first to be up and away when disturbed but often wheeled round after rising and then, as they were the first to rise, they were also the first once more to come within shot. In their actions, flight etc., they reminded me much of the Snipe-billed Godwit, a still rarer, less known bird. In fact the first two or three I shot were all killed under the impression that I was firing at the other species.

I never heard them utter any call beyond a sharp whistling note as they rose.

(*To be continued*).

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY.

BY

E. BLATTER, S.J., Ph.D., F.L.S.

PART XX.

(*With 2 plates*).

(*Continued from page 28 of this volume*).

BALSAMINACEAE

(Cke. under *Geraniaceae*).

IMPATIENS Linn.

Species about 350.—Tropical and N. temperate regions, especially mountains of India and Ceylon.

The Balsams (*Impatiens*) form one of the most perplexing groups of the Indian flora. J. D. Hooker himself was not satisfied with the results he had obtained from the Herbarium specimens upon which he had worked for the Flora of British India. 'The species were very often only to be distinguished by very delicate differences in the shape of the flowers and the relations of their parts, which were too often masked or crushed in the dried specimens. All his inexhaustible patience was needed in the tedious work of soaking the crumpled specimens from the paper to which they were heavily glued, and getting them into shape for drawing and examination under the microscope.'[1]

He began re-examining *Impatiens* in 1898. In one form or another this continued to be his principal occupation during the last ten years of his life. In the beginning he found classification difficult. 'I must confess,' he writes to Duthie in October 1898, 'that the outlook is far from reassuring, and I quail before it.'

The capsule offered the best primary division, but fruiting specimens were often absent, and in other cases the fruit appeared not to burst elastically with resilient valves. He then attempted to make use of the lip for classification, the saccate form in contradistinction to the funnel-shaped, at the same time making use of the sepals and the bracts. But all this did not overcome the worst difficulty. 'Without the wings,' he says, 'I am all at sea and the attempt to ascertain their forms is heart-breaking.' Here were many practical difficulties. It was impossible to ascertain the structure on dried flowers until they were moistened and dissected. 'I need not say that this is a most laborious process and one destructive of specimens, owing to the extreme delicacy of the tissues, the shocking state of the specimens in so many cases; owing too to the grievous carelessness with which the specimens are glued down, it often takes an hour to get out the flower from under the leaves; and two or even four to dissect it.'

In 1903 Hooker wrote to Gamble: 'I must now go to *Impatiens* which really terrifies me. I cannot get good groups, and they keep me awake.' When he had overcome the first systematic difficulties, he discovered that to complete his descriptions he had to examine most of the species afresh, and even then the descriptions were 'vague and loose', for 'every organ is variable except such as afford no character at all: it is like making species out of the waves of the sea.'

When he had to reject other botanists' identifications among the Balsams, as in Duthie's paper in the Records on Chitral plants, he confesses in 1909: 'I take to myself the blame, for you had nothing but the Fl. Brit. Ind. to refer to, and that is utterly unsatisfactory, full of imperfections and errors. In fact, it was not till after the publication of Vol. I of that work that I essayed a critical study of the Indian species by moistening and analysing every specimen where there could be any doubt. The consequent labour has been trying, for within my experience no genus of Phanerogams approaches *Impatiens* in difficulty of analysis, description and classification of species. Except by geographical areas it is impossible to bring the species under control, any attempt to bring all under one classification as in Fl. Brit. Ind. ends in chaos.'

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[1] Leonard Huxley: *Life and Letters of Sir Joseph Dalton Hooker*. London. 1918, ii, 377.

In spite of all the difficulties Hooker was able to finish his 'Epitome of the British Indian Species of Impatiens' in 1905, and it was published in 1906 in the Records of the Botanical Survey of India. To this he was able to add: 'On some Species of Impatiens from Indo-China and the Malayan Peninsula' (Kew Bull. 1909), and 'Indian Species of Impatiens' (Kew Bull. 1910).

The classification of species in the Epitome is widely different from that adopted in the Fl. Brit. Ind. Two reasons are assigned for this: 1. The number of new species described since the publication of the Flora and better materials of other species which has required a re-examination of the old sections. 2. The restriction of the vast majority of the species of *Impatiens* to its own area of distribution (E. Himalaya, W. Himalaya, Burma, Malabar, Ceylon, Malay Peninsula).

Future collectors may find the following note by Hooker of use: 'The points upon which most information, as not being obtainable from Herbarium specimens of *Impatiens*, is wanted, are the duration and habit of the species, the presence or absence of raphides in the leaves and floral organs. The colours of the flowers, with drawings if procurable, the nature and function of a dilation on the opposing margins of the wings which occurs nearly opposite the sinus between the lobes of the wings; this, which is often absent, may be produced into an ear-shaped lobule or into a thread descending into the spur: I have called it the dorsal auricle of the wings. The anther varies greatly in the genus and can rarely be described from Herbarium specimens. The fruits and seeds of many species are unknown, and, owing to the testa of the latter shrinking in drying, these should be described from fresh specimens. Pollination by insects is a very interesting process, which should be watched and described.

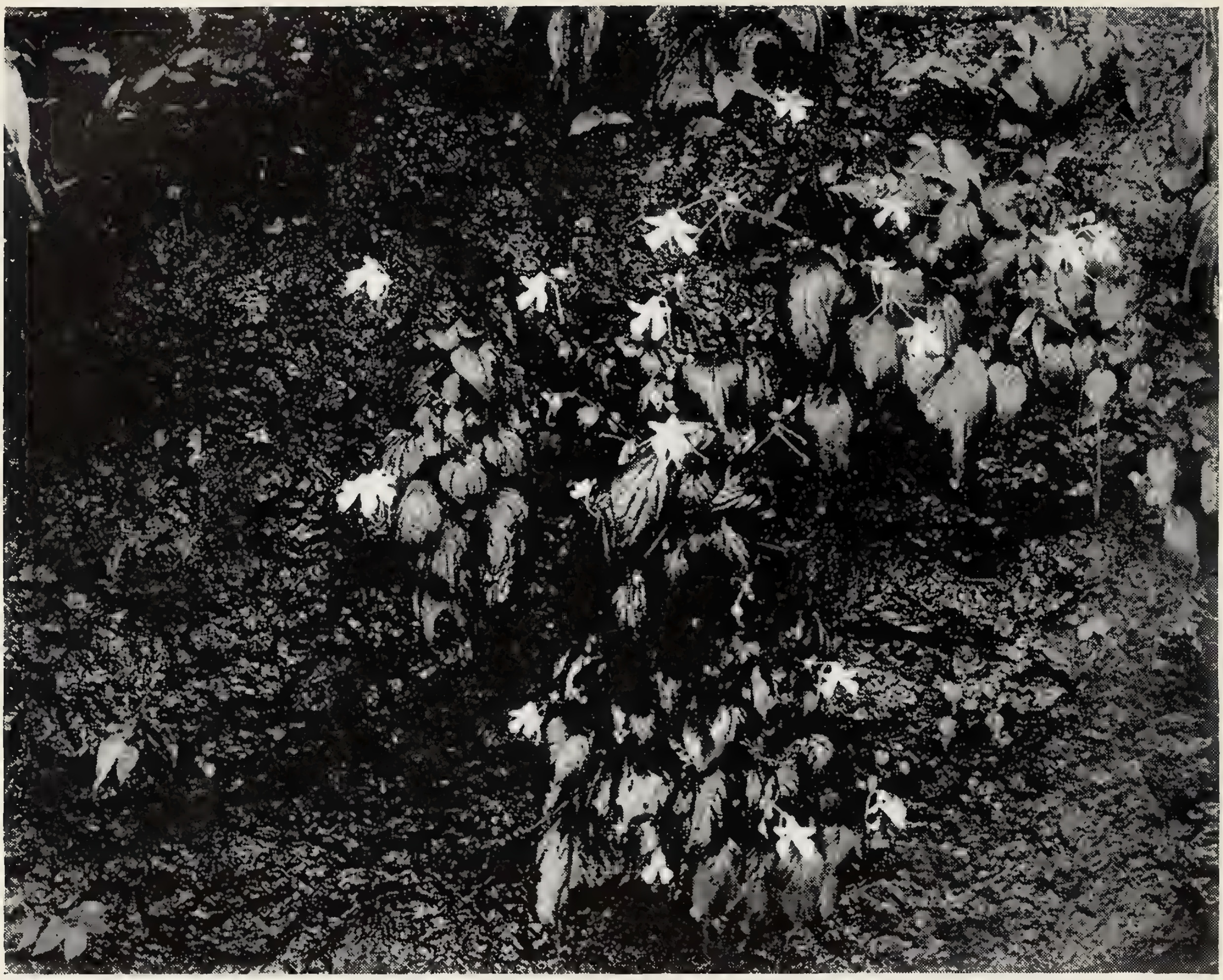
'In forming Herbarium specimens these should be laid in the sheets of a portfolio in the field, with spare flowers and with separate floral organs laid beside them. It is not recommended to preserve flowers in alcohol, which renders them very brittle.'

Cooke published *Impatiens* in 1901, 5 years before the appearance of Hooker's Epitome. He mentions 16 species. His *I. rivalis* Wight will be called *I. scapiflora* Heyne and *I. inconspicua* Benth. must cede to *I. pusilla* Heyne. To Cooke's 16 species we add 4 more: *I. kleiniformis* Sedgwick, *I. diversifolia* Wight., *I. Talboti* Hook. f. and *I. rupicola* Hook. f.

Key mainly after Hook. f.

I. *Scapigeræ.*—Rootstock tuberous; leaves all radical; scape radical; flowers racemose; seeds very minute, clothed with spiral hairs
  1. Lip with very long incurved spur
    a. Wings 2-lobed ... ... 1. *I. acaulis.*
    b. Wings 3-lobed ... ... 2. *I. scapiflora.*
  2. Lip with a short spur ... ... 3. *I. Beddomei.*
  3. Lip spurless ... ... 4. *I. Stocksii.*

II. Annual herbs
  1. Sepals linear or linear-lanceolate; seeds black and shining
    a. Spur of lip slender, longer than the wings or shorter
      * Stem stiff usually simple, leaves broad or narrow, coriaceous, serrate ... ... 5. *I. chinensis.*
      ** Stem slender simple or sparingly branched, leaves submembranous entire or subserrate ... 6. *I. rupicola.*
      *** Stem flaccid usually branched, leaves broad or narrow subentire 7. *I. diversifolia.*



A formation of *Impatiens acaulis* Arn. on vertical rocks.

Impatiens pusilla Heyne.

Photos by C. McCann.

**** Stem slender flaccid; wings long stipitate, no lines of pubescence on pedicels ... ... 8. *I. Kleinii.*
***** Stem slender flaccid; lines of pubescence on pedicels ... 9. *I. kleiniformis.*
b. Spur or lip very short or 0
* Lip scapfiform or cymbiform
† Flowers very small, spur of lip very minute or 0 ... 10. *I. pusilla.*
†† Flowers medium sized, yellow, standard winged, spur of lip minute or 0 ... 11. *I. Lawii.*
** Lip saccate, spur of lip very short
† Glabrous, flowers very small, lip shortly saccate ... 12. *I. oppositifolia.*
†† More or less pubescent, flowers medium sized, lip deeply saccate ... 13. *I. tomentosa.*
2. Sepals ovate or ovate-lanceolate, seeds various
Leaves opposite, 5-12.5 cm. long ... 14. *I. Dalzellii.*
III. *Microsepalae.*—Shrubs and herbs; leaves opposite, alternate and rarely whorled; flowers pedicelled; pedicels solitary, binate or fascicled in the axils of the leaves (peduncle 0); sepals small or minute; seeds smooth, rugose or papillose
1. Leaves opposite alternate and whorled on the same plant, seeds obovoid, rugose or papillose
a. Shrubs; basal lobe of wings smaller than the distal, spur of lip short, incurved; leaves 5-10 cm. long, petiole long ... ... 15. *I. latifolia.*
b. Herb, annual, lobes of wings subequal, spur of lip very slender ... 16. *I. lucida.*
2. Leaves all alternate
a. Capsule pilose or tomentose
* Lip spurred, seeds globose, smooth ... ... 17. *I. balsamina.*
** Lip spurless, seeds minute, granulate ... ... 18. *I. scabriuscula.*
b. Capsule glabrous, seeds glabrous, rugose, spur of lip long
* Flowers large ... ... 19. *I. pulcherrima.*
** Flowers small ... ... 20. *I. Talboti.*

1. **Impatiens acaulis** Arn. in Hook. Comp. Bot. Mag. I (1835) 325; Dalz. & Gibs. Bomb. Fl. 42.—*I. scapiflora* Hook. in Bot. Mag. 64 (1837) t. 3587 (*non* Heyne).

We found white flowers on the Fitzgerald Ghat.

The seeds in this species are minute and yellowish brown. They are armed with minute hooks which probably help in fastening them to the perpendicular rocks on which these plants grow.

Locality: *W. Ghats*: Khandala (Woodrow !, Hallberg !, McCann !); Lonavla (Woodrow !); Mahableshwar (Cooke !); Fitzgerald Ghat (Cooke !, McCann !, Blatter !, Fernandez !).—*Konkan*: Hills of Konkan (Stocks); Matheran (Birdwood).

This species grows on rocks in such places where water trickles down. The plants dry down during the dry months but the rootstocks remain adhering to the rocks and sprout again with the next rains.

Distribution: From the Konkan to Travancore, ascending to 7,000 ft. in the Nilgiris, Ceylon.

2. **Impatiens scapiflora** Heyne in Roxb. Fl. Ind. ed. Carey II, 464; Gamble Fl. Madras (1915) 138.—*I. rivalis* Wight in Madras Journ. 13, t. 8; Ic. t. 751; Dalz. & Gibs. Bomb. Fl. 42; Hook. f. Fl. Brit. Ind. I (1874) 444; Cke. I (1901) 170.—*I. verrucosa* Bedd. in Madras Journ. IV, 69, t. 7, f. 9.

Locality: *Konkan*: (Stocks).—*W. Ghats*: Ramghat (Dalzell); usually on dripping rocks.

Distribution: From S. Kanara to Travancore, from 6,000-8,000 ft.

3. **Impatiens Beddomei** Hook. f. Fl. Brit. Ind. I (1874) 472; Cke. I (1901) 169.—*I. scapiflora* Wight & Arn. Prodr. 137; Wight Ic. t. 967; Graham Cat. 34 (*non* Heyne).

According to Gamble (p. 138) the flowers are white with yellow patches on the wings.

Distribution: Bombay Konkan, W. Ghats at 6,000-8,000 ft. in the Nilgiris, on the downs.

4. **Impatiens Stocksii** Hook. f. & Th. in Journ. Linn. Soc. 4 (1860) 119; Dalz. & Gibs. Bomb. Fl. 42; Cke. I (1901) 170.

Distribution: Bombay Konkan.

5. **Impatiens chinensis** Linn. Sp. Pl. (1753) 937; Cke. I (1901) 171.—*I. fasiculata* Lam. Encycl. I, 363; Wight Ic. t. 748.

Distribution: Konkan and Kanara of Bombay Presidency, E. Ghats at 5,000 ft., W. Ghats of Madras Presidency, in all districts at 5,000-8,000 ft., Bhutan, Khasia Mts., Burma, Tenasserim, (not in Malay Peninsula !), China.

6. **Impatiens rupicola** Hook. f. in Kew Bull. (1910) 292.

Description: A herb, 30-40 cm. high, erect, almost glabrous, small-flowered; stem slender, simple or sparingly branched; internodes elongate. Leaves opposite, sessile or very shortly petiolate, 3-8 cm. long, submembranous, oblong, obovate-oblong or linear, acute, quite entire or subserrate, rotund at the base, cordate or acute, nerves obscure; infrapetiolar glands subulate or O. Inflorescence simply pedicellate; pedicels solitary or 2 together, very slender, 3-4 cm. long, glabrous or puberulous, spreading or in fruit deflexed. Flowers 1.5-2 cm. when expanded, rose or rose-purple, raphides 0. Sepals 2, linear, acuminate, 7-10 mm. long, 3-nerved, glabrous, rarely pilose. Vexillum orbicular, cucullate, 8-10 mm. diam., midvein keeled on the back, keel mucronate, gibbous at the lower end. Wings broadly stipitate, 1.2-1.5 cm. long; basal lobe small, trigonous, erect, distal lobe much larger, stipitate, orbicular or obovate; dorsal auricle rotund, porrect or decurved. Limb of labellum deeply cymbiform, ascending mouth obtuse, apiculate, spur very small, incurved. Filaments subulate; anthers connate, decurved. Ovary straight, acute at the apex and incurved. Capsule ellipsoid, shortly stipitate, long and acutely rostrate, 12-15 mm. long, many-seeded. Seeds orbicular, compressed, 2-2.5 mm. diam., smooth, black or chestnut brown, shining.

This species is nearly related to *I. chinensis*, but can be distinguished by the entire leaves, by the flowers and capsules being much smaller and by the very small spur of the lip. Hooker himself thinks that *I. rupicola* may prove to be a 'small flowered and fruited, almost spurless state of *I. chinensis*, which it seems to represent in the Western Ghats from the latitude of Goa to that of Poona.'

Locality: *W. Ghats*: Khandala, 2,000 ft. (Meebold 8813); Belgaum, N. Hills (Ritchie 120); Castle Rock, 2,000 ft. (Meebold 10719).—*N. Kanara* (Talbot 2514).

Flowers: September 1891 (N. Kanara); September 1907 (Khandala); October 1908 (Castle Rock); November 1902 (Belgaum).

Distribution: Mysore, Shimoga, 2,000-3,000 ft.

7. **Impatiens diversifolia** Wall. Cat. 4749; Hook. f. Fl. Brit. Ind. i (1874) 446; Rec. Bot. Surv. Ind. iv (1906) 46.—*I. arnottiana* Miq. in. Herb. Hohenack. 275.

Description: Diffuse with ascending branches, quite glabrous. Stems very succulent, 30 cm. or more long, rooting at the nodes. Leaves all opposite, 12 mm.-7·5 cm., faintly serrate, lower shortly petioled, elliptic or oblong-obtuse, upper sessile, linear-oblong or ligulate, base cordate, all very flaccid when dry; stipules obscure, glandular. Pedicels solitary or twin, with a faint line of pubescence, usually longer than the leaf, deflexed in fruit. Flowers 18 mm.

diam., rose, rotate. Sepals linear-acuminate; standard small, wings broadly semiobovate; spur filiform, ascending, sometimes thick, inflated, equalling or exceeding the flower. Capsule 8 mm., ellipsoid, turgid. Seeds globose, dark brown, smooth, shining.

Locality: *Konkan* (*ex* Hook. f.).

Distribution: W. Ghats, from S. Kanara to Travancore, Nilgiris up to 6,000 ft.

8. **Impatiens Kleinii** Wight & Arn. Prodr. (1834) 140; Wight Ic. t. 884; Hook. f. Fl. Brit. Ind. i, 445; Kew Bull. (1910) 293; Cke. i, 171.—*Balsamina minor* DC. Prodr. i, 686.—Rheede Hort. Mal. ix, t. 50, 51.

Description: Cke. i, 171.—Hook. f. (Kew Bull. 1910, 293) examined a number of specimens collected by Meebold in the Bombay and Madras Presidencies, which present great variety of habit and foliage, but singular agreement in floral organs and fruit. He gives the following notes on the species: In small specimens the stems are 1.5-2 dm. long or high, erect or diffusely branched, in larger they exceed 3 dm. The leaves are sessile or very shortly petioled, quite glabrous, 2-8 cm. long, orbicular, ovate, elliptic, oblong or linear, nearly quite entire, acute or obtuse, base rounded or contracted, very rarely cordate, the upper ones biglandular at the base. The pedicels are 1-2 cm. long, always glabrous, solitary or binate, lengthening in fruit but rarely equalling the leaves. The minute flowers are white or pale pink or violet-purple, rarely pilose. The linear, acute or subacute sepals vary in breadth and are 1-3-nerved. The small, hooded, apiculate, green standard is dorsally keeled. The obovate or rounded distal lobe of the wings is stipitate for about its own length with no trace of a basal lobe or dorsal auricle on the stipes. The slender spur of the lip is usually about twice the length of the limb, and usually strongly incurved. The filaments are very slender, nearly equal in length, and the minute anthers nearly erect. The ripe capsules are 1-1·5 cm. long, linear or turgidly ovoid, straight, shortly stipitate, acutely beaked, few-seeded; seeds orbicular, compressed, 2·5 mm. diam., black, shining.

Locality: *W. Ghats*: Lonavla, 2,000 ft. (Meebold 8910, Blatter !); Castle Rock, 2,000 ft. (Meebold 10714-17).—*Konkan* (Stocks): Miradonger (Dalzell).—*N. Kanara*: (Hallberg); Sampkhand (Woodrow).

Flowers: September 1907 (Lonavla); October 1908 (Castle Rock, Talguppa, Gersoppa Falls); November 1908 (Shukravarsanti).

Distribution: Madras Presidency: W. Coast and Ghats, in most districts, from sea-level up to 6,000 ft.

9. **Impatiens kleiniformis** Sedgwick in Rec. Bot. Surv. Ind. vi (1919) 351.

Description: An erect herb, branching, flaccid, up to 25 cm. high, similar in habit to *I. Kleinii*. Leaves opposite, largest in the middle of the stem, up to 9 cm. long and 2·5 cm. broad, elliptic or oblong, towards the apex getting smaller, crenate and subulate in the crenatures, the uppermost sessile and cordate at the base, the lowest leaves attenuate into a 1 cm. long petiole, glabrous or on the midrib and nerves below sparingly and inconspicuously hirsute, always eglandular and exstipulate. Peduncles axillary, solitary or 2-3-fascicled, during flowering time erect, later on deflexed, very slender, up to 2 cm. long, provided with 2 opposite lines of pubescence. Flowers up to 6 mm. broad, rose, but on the inner side of each wing provided with a longitudinal purple line. Dorsal petal slightly hirsute-keeled and gibbous at the base. Wing with long claws, entire and without auricles. Spur up to 9 mm. long, filiform, subacute. Capsule (not quite ripe) up to 1.5 mm. long, fusiform. Seeds black, glabrous, polished.

Nearly allied to *I. Kleinii*, but can be distinguished by the lines of pubescence on the pedicels, the sessile upper leaves with cordate base, and the absence of glands. It is slightly larger and the flowers are smaller for the size of the plant, paler pink, but with two darker lines on the wings. 'In connection with the glands at the base of *I. Kleinii*,' Sedgwick observes, 'it has been assumed that those glands are metamorphosed stipules; but they are marginal on the leaf base, and often more than one on each side of the leaf. They seem more properly to represent a glandular development of the basal and supra-basal serratures of the leaf-margin.'

Locality: *W. Ghats*: Castle Rock, about 1,600 ft., rainfall about 250 inches, in ditches by the railway lines and wet places near it (Sedgwick !).

Flowers: August 1917.

See: L. J. Sedgwick: Herbaceous monsoon flora at Castle Rock and a new species of Balsam. In Journ. Bomb. Nat. Hist. Soc. XXV (1918) 482.

10. **Impatiens pusilla** Heyne *ex* Wall. Cat. n. 4745; Hook. f. & Th. in Journ. Linn. Soc. ser. IV (1860) 122; Hook. f. in Kew Bull. (1910) 293; Gamble Fl. Madras 140.—*I. inconspicua* Benth. in Wall. Cat. n. 4,741; Wight & Arn. Prodr. 139; Wight Ic. t. 970; Dalz. & Gibs. Bomb. Fl. 43; Hook. f. Fl. Brit. Ind. I, 447, *et in* Rec. Bot. Surv. Ind. iv (1906) 41, 46; Cke, I, 171.—*I. inconspicua*, var. 2. *pusilla*, *var.* 3. *filiformis*, *var.* 4. *ramosissima* Hook. f. Fl. Brit. Ind. I, 448: Cke. I, 172.—*I. oppositifolia* Herb. Wight *ex* Wall. Cat. n. 4743B (*non* Linn.).—*I. filiformis* Wight & Arn. Prodr. 140.—*I. ramosissima* Dalz. in Hook. Kew. Journ. Bot. iii (1851) 230—*I. rosmarinifolia* Wight Ic. t. 750 (*non* Retz.)—*I. Perrottetti* Turz. in Bull. Soc. Nat. Mosc. xxxvi (1863) 594; Hook. f. in Hook. Ic. Pl. t. 2909.

Description: Cke. i, 171.—According to Cooke the flowers are pink. Gamble calls them white streaked with lilac.

'*I. pusilla* is as variable and common a species in the Western Ghats as *I. oppositifolia* and *I. Kleinii*, from which it may be distinguished by the cymbiform spurless or almost spurless lip.' (Hook. f.)

Locality: *Konkan*: Abundant on many hills (Law, Stocks).—*W. Ghats*: Khandala (Graham); Shirgaon Ghat (Fernandez !); Mahableshwar (Hallberg !). —Common throughout the Presidency.

Flowers: August 1928 (Shirgaon Ghat); August-October (*ex* Cke.).

Distribution: Madras Presidency: W. Ghats, in all districts, 3,000-8,000 ft., very common.

11. **Impatiens Lawii** Hook. f. & Th. in Journ. Linn. Soc. iv (1860) 122; Hook. f. Fl. Brit. Ind. i, 448; Dalz. & Gibs. Bomb. Fl. 43; Cke, i, 172.

Description: Cke. l.c.

Locality: *Konkan* (Dalzell & Gibson, Law).—*W. Ghats*: Castle Rock (Woodrow !).—*N. Kanara* (*ex* Hook. f.).

Distribution: Bababudan Hills of Malabar.

12. **Impatiens oppositifolia** Linn. Sp. Pl. (1753) 937; Graham Cat. 34; Wight & Arn. Prodr. 139; Wight Ic. t. 883; Hook. f. Fl. Brit. Ind. i, 448; Cke. i, 172.—*I. rosmarinifolia* Retz. Obs. v, 29 (*non* Wight).—*Balsaminifolia rosmarinifolia* DC. Prodr. i, 686.

Locality: *Konkan*: (Stocks, Dalzell); Vengurla (Dalzell); Wadi to Paladpur (Woodrow).—*W. Ghats*: Lonavla (Hallberg !); Palghat (Dalzell); hills N. of Belgaum (Ritchie 120).—*N. Kanara*: Tinai (Talbot); Halyal (Talbot).

Distribution: Madras Presidency: W. Ghats, in all districts, common at 3,000-5,000 ft., Ceylon, Burma.

13. **Impatiens tomentosa** Heyne in Wall. Cat. (1828) n. 4751; Dalz. & Gibs. Bomb. Fl. 43 (*excl. syn. I. ramosissima*); Wight Ic. t. 749; Hook. f. Fl. Brit. Ind. i, 449; Cke. i, 173; Gamble Fl. Madras 141.—*I. rufescens* Benth. in Wall. Cat. (1828) n. 4747; Wight Ic. t. 969.

Description: Cke. i, 173.—Flowers pink.

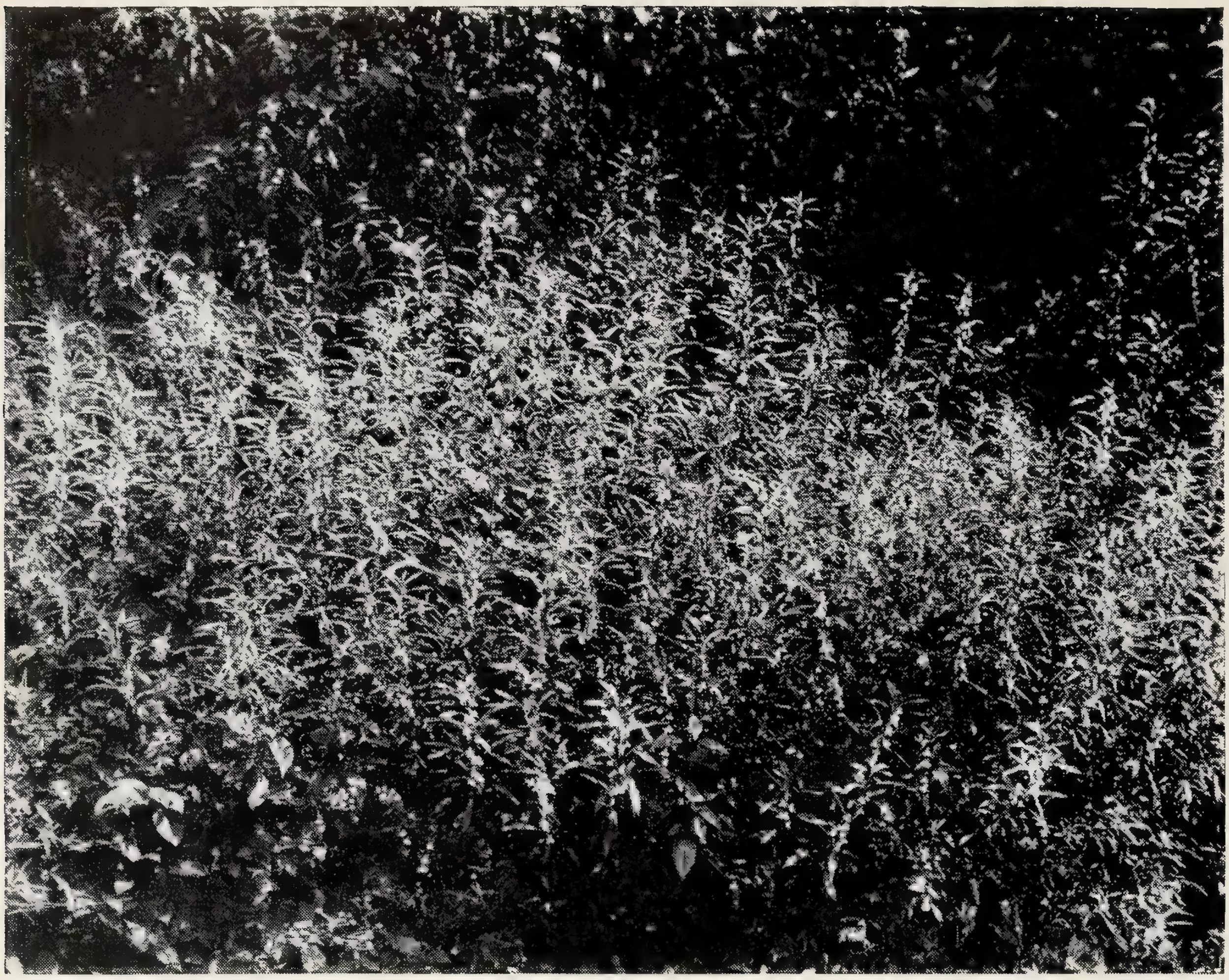
Locality: *Konkan* (*ex* Hook. f.).—*W. Ghats*: Phunda Ghat (Dalzell & Gibson).

Distribution: Madras Presidency: Nilgiris to Travancore, in boggy places, 5,000-8,000 ft.

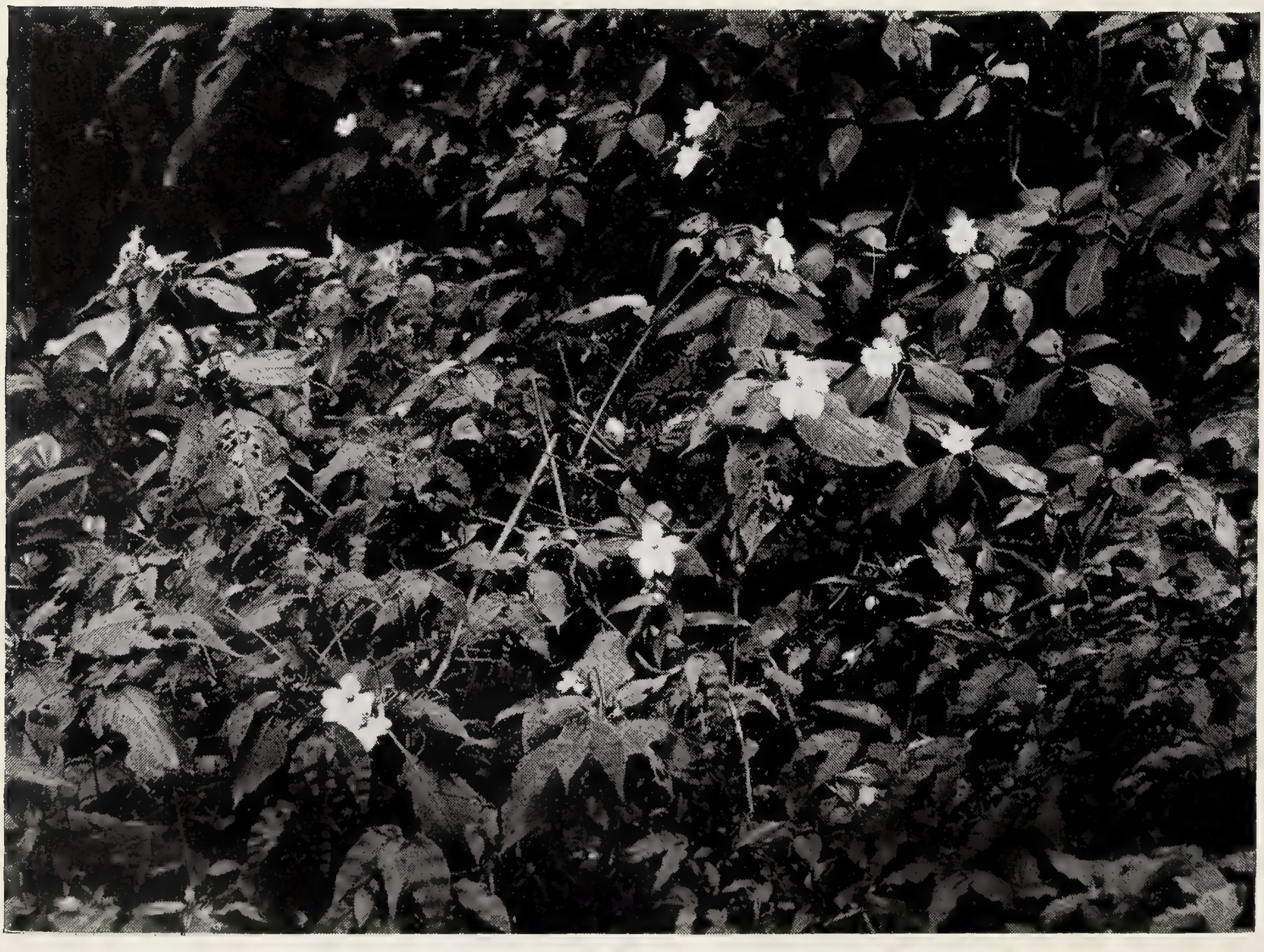
14. **Impatiens Dalzellii** Hook. f. & Th. in Journ. Linn. Soc. iv (1860) 123; Dalz. & Gibs. Bomb. Fl. 43; Hook. f. Fl. Brit. Ind. i, 449; Cke. i, 173.

Description: Cke. i, 173.—I have examined many specimens and am, therefore, able to give a more detailed description, at the same time correcting a number of inaccuracies.

Height 10 cm. to 1.2 m. Tap-root white, but not always present, fibrous roots arising chiefly at the base of stem; lower part of stem producing many adventitious roots which are red where exposed. Stem fleshy, succulent, striate (speckled red in longitudinal rows). Internodes up to 13 cm. long. Leaves oblong-lanceolate, up to 15 cm. by 5 cm., upper leaves in our specimens not linear and no long cilia to basal serratures of leaves, quite glabrous, cordate or subcordate or acute at base, veins depressed above, prominent below. Petioles of lower leaves, up to 4 mm. Flowers up to 9 mm. across. Bracts 2, ovate-acuminate, lower half fleshy, upper half scarious. Peduncles up to 2·5 cm.,



Impatiens balsamina Linn. in pure association.



A formation of *Impatiens pulcherrima* Dalz.

Photos by C. McCann.

pedicels up to 4 cm. long; fascicles up to 6-flowered. Usually 1 or 2 flowers open at the same time. Pedicels deflexed in fruit at an angle of 45-80° to the stem. Sepals 6 mm. long, 1·5 mm. broad, with a very broad keeled midrib, hard, with a brown spine. Standard broadly orbicular, irregularly crenulate or entire, yellow, 6 by 8 mm., with a high green irregularly cut crest which ends above into a brown-black spine, spine sometimes with a white band. Wings: A ½ obovate lateral lobe, 6 mm. long, 4 mm. broad, finely apiculate, terminal lobe at or almost at a right angle to the lateral one, obliquely ovate (not obovate), as long and broad, as the lateral one; terminal lobes of wings usually overlapping, sometimes spreading, leaving a deep sinus between them; claw about 1 mm. long. Lip broadly boat-shaped, 9 mm. long, 4 mm. broad, acuminate, spinous-tipped, transversely marked with red-brown streaks or U-shaped markings at the bottom of the boat and a spot of the same colour at the bottom towards the apex, also 3-5 darker longitudinal lines in the roof of the spur, passing to where the spur bends; all the markings, except the spot, also visible outside. Spur about 3 mm. long, subacute or bluntish. Ovary oblong, 5-celled, 5-lobed, slightly bent near apex. Capsules (still green) 15 mm. long, 8 mm. broad, deeply 5-lobed, thick in the middle, getting thinner at both ends, backs of lobes rounded. Seeds up to 5, large, oblong, curved, 3-4 by 2·5-3 mm., smooth, shining, obliquely truncate at base, rounded at apex, flattened on one length-side, rounded on the opposite side, black.

The flowers are very caducous, coming out at the beginning of July and flowering up to November.

Cooke says that the pedicels are not, or rarely, deflexed in fruit. I nearly always found them deflexed. If, in isolated cases, they are not deflexed, it is because they find a mechanical resistance in the leaves. These are sometimes firmly pressed down by the pedicels if the latter don't find the right turn beween the opposite leaves.

Usually growing in loose soil and can, therefore, easily be removed from the ground.

Locality: *Konkan*: Hills (Dalzell, Stocks).—*W. Ghats*: Purandhar (Woodrow); Mahableshwar (Cooke, Blatter !); Panchgani (Hallberg !, Blatter !, McCann !), very common.

Distribution: Endemic.

15. **Impatiens latifolia** Linn. Sp. Pl. (1753) 937; Graham Cat. 34; Dalz. & Gibs. Bomb. Fl. 44; Hook. f. Fl. Brit. Ind. i, 450 (*excl. syn. I. cuspidata* Wight & Arn.); Cke. i, 174.—*I. bababudenensis* Hook. f. in Kew Bull. (1910) 295 (*probabiliter sec.* Gamble).—*Balsamina latifolia* DC. Prodr. i, 686.—Rheede Hort. Mal. ix, t. 48.

Description: Cke. l.c.

Locality: Common on the Konkan hills.

Distribution: Madras Presidency: S. Kanara to the Pulney Hills, up to 8,000 ft.

16. **Impatiens lucida** Heyne in Wall. Cat. (1828) n. 4738; Hook. f. Fl. Brit. Ind. i, 451 (*excl. syn. I. latifolia* Wight & Arn.); Cke. i, 174.

Description: Cke. l.c.

Locality: *Konkan*: (Stocks).

Distribution: Madras Presidency: From S. Kanara to Travancore, up to 4,000 ft.

17. **Impatiens balsamina** Linn. Sp. Pl. (1753) 938; Hook. f. Fl. Brit. Ind. i, 453; Cke. i, 174; Gamble Fl. Madras 142.

This species occurs all over India, Ceylon, China and Malaya. As to its varieties Hook. f. wrote to Gamble in 1904: 'I am having an awful time over the varieties of *I. balsamina*, which are legion and strangely diverse. . . . I have no faith in a single character of any one form; most of these being taken from single specimens. As, however, I indicate the locality of each form, future collectors may be led to investigate them in their homes.—I have written asking Talbot for the loan of his Balsams (of the Deccan), a suicidal proceeding, for if he has collected *I. balsamina* with care, his specimen will be sure to upset my beloved varieties.'

As the Peninsula forms of this species present such great differences, Hook. f. attempted in an appendix to his Epitome i (Rec. Bot. Surv. Ind. iv, 49) to discriminate the most remarkable of them. It is from this appendix that we adopt the key for the chief varieties found in the Bombay Presidency.

I. Leaves usually crowded, 7-20 cm. long
  1. Leaves lanceolate or oblanceolate; flowers subsolitary, spur of lip much longer than limb ... ... a. *var. vulgaris* proper.
  2. Leaves linear-lanceolate, pedicels 2-3-nate, flowers rather large, spur of lip shorter than the limb, strongly incurved ... b. *var. rosea.*

II. Leaves very small, 2·5-5 cm. long, pedicels solitary or binate, short. Stem stout, much branched, leafy, leaves small, subsessile, ovate-obtuse, thick, flowers small, sepals very minute, obtuse, standard orbicular, spur of lip stout, incurved ... ... c *var. agrestis.*

a. **Var. vulgaris** proper Hook. f. Fl. Brit. Ind. I, 454.—*I. balsamina* Dalz. & Gibs. Bom. Fl. 44; Graham Cat. 34.—*I. cornuta* Linn. Sp. Pl. (1753) 937.—*I. coccinea* Sims.

Locality: This is the common form in the Presidency. Widely distributed in the Konkan, the W. Ghats and the Deccan.

Distribution: Widely distributed in tropical E. Asia.

b. **Var. rosea** Hook. f. Fl. Brit. Ind. I, 454.—*I. rosea* Lindl. Bot. Reg. (1841) t. 27.—*I. balsamina var. brevicalcarata* T. Cooke Fl. Bomb. I, 174.

Locality: *W. Ghats*: Mahableshwar (Cooke !, Hallberg !); Panchgani (Hallberg).

Distribution: Godavari District at Samalcotta, W. Himalaya.

c. **Var. agrestis** Hook. f. in Rec. Bot. Surv. Ind. IV (1906) 50.

Locality: Abundant, colouring ploughed fields in the Satara district; eaten by animals (*ex* Hook. f.).

Colour variations.

a. Rose. Terminal wing-lobes with very distinct white longitudinal markings, sharpest below where the end is yellow and disappears before reaching the margin. Limb of lip pale along the midlobe, with a lineated yellow spot about half way down. Tip of spur pale green. Stem reddish; pedicels darker; glands almost black.

Locality: Bombay Island. Common during the rains.

b. Almost white. Lip delicately pink, white inside, with a lineated yellow spot. Standard with a pinkish central part. Lateral wing-lobes very faintly pink.

Locality: Sewri (Bombay Island); Versova (Salsette).

Flowered in September.

c. Like a; but flowers much smaller, especially midlobe of wings which has a broad pale green margin or is entirely pale green. Much of standard and lip green.

Locality: Sewri (Bombay Island) rare.

Flowered in September.

18. **Impatiens scabriuscula** Heyne in Roxb. Fl. Ind. (ed. Carey) II (1824 464; Dalz. & Gibs. Bomb. Fl. 44; Bedd. Ic. Pl. Ind. Or. 29, t. 144; Cke. I, 174.

Description: Cke. l.c.

Locality: *Konkan*, apparently rare.

Distribution: Madras Presidency: From S. Kanara and Coorg to the Wynaad and Nilgiris, up to 6,000 ft.

19. **Impatiens pulcherrima** Dalz. in Hook. Kew Journ. Bot. II (1850) 37; Hook. Bot. Mag. (1851) t. 4615; Dalz. & Gibs. Bomb. Fl. 41; Hook. f. Fl. Brit. Ind. I, 458; Cke. I, 175; Gamble Fl. Madras 143.

Description: Cke. l.c.

Locality: *Konkan* (Dalzell & Gibson, Woodrow).—*W. Ghats*: Fitzgerald Ghat (McCann !, Blatter !).—*S.M. Country*: Londa (Woodrow, Hallberg !).

Flowers: Aug. 1930 and Nov. 1929 (Fitzgerald Ghat).

Distribution: Mysore.

20. **Impatiens Talboti** Hook. f. in Rec. Bot. Surv. Ind. IV (1906) 47.

Description from Hook. f.'s MS. kindly supplied by C. E. C. Fischer of the Kew Herbarium.

An annual herb, 2-3 dm. high, glabrous or branchlets and leaves pubescent. Stem simple, suddenly erect from the base, nude for a long distance, few-leaved towards the apex. Leaves 6-10 cm. long, alternate, long-petiolate, broadly or elliptic-ovate or -oblong, acuminate at both ends, remotely subserrate, membranous, ciliate towards the base, narrowed into a slender 1-3 cm. long naked or glandular petiole; nerves 6-8 pairs; stipular glands O. Pedicels solitary, short, 1-2 cm. long, in fruit elongate, straight or decurved. Flowers 2-2.5 cm. when expanded. Sepals 2, minute, 2-6 mm. long, subulate or deltoid-ovate. Vexillum orbicular, concave, 6-10 mm. diam., below the apex on the back spurred, cuspidate. Wings sessile, 1-2 cm. long; lobes broadly obcordate, basal one ample, subquadrate, bilobulate, dorsal auricle prominent. Limb of labellum short, 10 mm. long, saccate, cymbiform, at the mouth ascending acuminate; spur slender, 2-3 cm. long, straight, pendulous, acute, incurved when young. Filaments subulate; anthers didymous. Ovary ovoid, attenuate into a short style; stigmata subulate. Capsules small, almost globose, 5-8 mm. diam., scarcely stipitate, obscurely rostrate, few-seeded. Seeds subglobose, 3-4 mm. diam., compressed, glabrous, tuberculate, brown.

A near ally of *I. pulcherrima and dasysperma* distinguished from the former by its small stature, leaves and flowers, from the latter by the form and serration of the leaves and the smaller capsule. It inhabits a very much lower level than either of the above.

Locality: *N. Kanara*: (Law); Devimane Ghat, 2,600 ft. (W. A. Talbot 3722); Castle Rock, 2,000 ft. (Meebold 6960).

RUTACEAE (Cke. I, 175).

Genera 100, species 800.—Tropical and temperate, especially S. Africa and Australia.

1. RUTA (Tourn.) Linn. (Cke. I, 176).

Species 50.—Chiefly Mediterranean, W. and Central Asian. As in Cke.

2. EVODIA Frost. (Cke. I, 177).

Species 45.—Tropics, except America.

1. **Evodia roxburghiana** Benth. Fl. Hongk. (1861) 59 (*partim*); Hook. f. Fl. Brit. Ind. I, 487 (*partim*); Brandis Ind. Trees 112 (*partim*); Cke. I, 177 (*partim*) —*E. malayana* Ridl. Fl. Malay Penins. I (1922) 342.—*Zanthoxylum Roxburghianum* Cham. in Linnaea (1830) 58, *in nota*.—*Fagaria triphylla* Fl. Ind. ed. Carey I (1820) 436.

Locality: Cke. I, 178.

Distribution: Bombay Presidency; Madras Presidency: W. Ghats, from Mysore to Tinnevelly, up to 7,000 ft., in evergreen and secondary forests, E. Ghats; Ceylon, Sumatra, Java.

3. ZANTHOXYLUM Linn. (Cke. I, 178).

Species 80.—Tropical and warm regions of the world.

Cke. describes 2 species, *Z. ovalifolium* and *Z. Rhetsa*. As to the latter I follow Haines in combining it with *Z. Budrunga*.

1. **Zanthoxylum ovalifolium** Wight Ill. I (1840) 169.

Locality: *N. Kanara*: Rain forests of the Sirsi and Siddhapur sub-divisions (*ex* Talbot).

Flowers: Feb.-March (Talbot); Nov. and Dec. (Cooke).

Fruit: Ripens in the cold season.

Distribution: W. Ghats of Madras Presidency: From S. Kanara to Tinnevelly; up to 4,000 ft.

2. **Zanthoxylum Budrunga** Wall. Cat. 1221; Hook. f. Fl. Brit. Ind. I, 495.—*Fagaria Budrunga* Roxb. Fl. Ind. I (1832) 417.—*Z. Rhetsa* DC. Prodr. I (1824) 728; Wight & Arn. Prodr. 148; Graham Cat. 36; Dalz. & Gibs. Bomb. Fl. 45; Hook. f. Fl. Brit. Ind. I, 495; Cke. I, 178.—*Fagaria Rhetsa* Roxb. Fl. Ind I (1832) 417.

Description. A small or moderate sized tree with pale corky bark, covered with conical prickles on stems and branches and sometimes a few small ones on the leaf rhachis. Leaves clustered towards the ends of the stout branchlets, 45-60 cm. long (with the petiole). Leaflets 19-25 or fewer, somewhat like those of a Toon, 7.5-15 cm. long, oblong or lanceolate, caudate, entire or crenate, when crenate with a large gland in the sinus. Flowers 4.3 mm. diam., yellow, 4-merous, in large terminal panicles with opposite branches.

Haines justifies his combination by the following remark: I think it is impossible to separate *Z. budrunga* and *Z. rhetsa.* The former is usually the North India form, the latter usually the Peninsula form, and, as might be expected, the Bihar and Orissa plant unites the two, that from Bishanpur being more nearly *Z. budrunga* and that from Puri more nearly *Z. rhetsa*, but even in the latter some leaflets are crenate. Again, some Sikkim and Chittagong specimens occur with entire leaves and several have been doubtfully named in the Calcutta Herbarium. Moreover, the characters used by Roxburgh to discriminate the two species are not the leaf crenatures, and both his descriptions and figures show the leaves of both species quite entire ! He evidently knew his '*Fagara Rhetsa*' well, but seems to have had a specimen of *F. budrunga* with very few leaflets.

Locality: Khandesh, Konkan, W. Ghats, N. Kanara.

Distribution: Madras Presidency: W. Ghats in S. Kanara, Mysore, Malabar, Anamalais and Travancore at low elevations, E. Ghats. Tropical Himalaya, Sylhet, Khasia Mts., Chittagong, Martaban.

4. TODDALIA Juss. (Cke. I, 179).

Species 1.—Tropical Asia, Africa, Madagascar.

Cke. calls one species *T. aculeata* Pers. It has to cede to *T. asiatica* Lam. The other species *T. bilocularis* has to go under *Vepris.*

1. **Toddalia asiatica** Lam. Ill. II (1793) 116; Gamble Fl. Madras 150: Haines Bot. Bih. & Or. 160.—*T. aculeata* Pers. Syn. I (1805) 249; Graham Cat. 37; Dalz. & Gibs. Bomb. Fl. 46; Wight Ill. t. 66; Engl. in Engl. & Prantl Pflanzenf. III, 4, 176 fig. 101 A-K; Hook. f. Fl. Brit. Ind. I. 497; Cke. I, 179.—*I. floribunda* Wall. Pl. As. Rar. III, 37.—*Scopolia aculeata Sm.* Ic. ined. *sub.* t. 34; Roxb. Fl. Ind. I (1832) 616.—*Limonia oligandra* Dalz. in Kew Journ. Bot. II (1850) 258; Dalz. & Gibs. l.c. 28.—*Paullinia asiatica* Linn. Sp. Pl. (1753) 365.

Description: Cke. I, 179.

Locality: Konkan, W. Ghats, N. Kanara.

Distribution: Throughout the W. Peninsula, Ceylon, subtropical Himalaya, from Kumaon to Bhutan up to 5,000 ft., Khasia Mts., up to 6,000 ft., Sumatra, Java, China, Phillippines.

5. VEPRIS Comm. *ex* A. Juss in Mem. Mus. Par. 12 (1825) 509.

Trees or shrubs, unarmed. Leaves alternate, 1-3-foliolate, the leaflets usually petiolulate, gland-dotted. Flowers small, in terminal or axillary panicles. Calyx small, saucer-shaped, 2- or more- lobed. Petals 2-4, lanceolate or ovate, more or less imbricate. Stamens in male flowers twice or three times as many as the petals, inserted under the disk, filaments slender; anthers ovate; in female flowers reduced to minute staminodes with small rudimentary anthers. Ovary in male flowers small, ovoid, 2-cleft at apex; in female flowers globose 2-4-celled; styles 0; stigma capitate; ovules in each cell 2, collateral. Fruit globose or oblong, 2-4-celled, fleshy. Seeds one in each cell, flattened, oblong, testa crustaceous; albumen fleshy; embryo flat, cotyledons thick, ovate; radicle stout.

Species about 16.—Africa, Mascarene Islands, India.

1. **Vepris bilocularis** Engl. in Engl. & Prantl Pflanzenf. III, 4 (1896) 178.—*Toddalia bilocularis* Wight & Arn. Prodr. (1834) 149; Dalz. & Gibs. Bomb. Fl. 46; Bedd. For. Man. in Fl. Sylv. p. XLIII *et* Ic. t. 167; Hook. f. Fl. Brit. Ind. I, 497; Cke. I, 180.—*Dipetalum biloculare* Dalz. in Kew Journ. Bot. II (1850) 38.

Description: Cke. I, 180.

Locality: Very rare in the Presidency. Found only once in N. Kanara by Dalzell.

Distribution: Madras Presidency: Forests of Malabar, Anamalais and Travancore up to 4,000 ft.

6. ACRONYCHIA Forst. (Cke. I, 180).

Species 20.—Tropical Asia and Australia.

1. **Acronychia laurifolia** Blume Cat. Gew. Buitenz. (1823) 63; Cke. I, 180.
Locality: Konkan, N. Kanara.
Distribution: Madras Presidency: N. Circars, S. Deccan slopes in Salem; W. Ghats in hill forests up to 6,000 ft.; Sikkim Himalaya, Khasia Mts., Assam, Chittagong, Malay Peninsula, Sumatra, Java, Cochin-China.

7. GLYCOSMIS Corr. (Cke. I, 181).

Species 6.—Indo-Malayan.
By some *G. arborea DC.* and *G. pentaphylla* Corr. are kept separate (see Haines Bot. Bih. & Or. 163). Hook. f. united them under *G. pentaphylla* Corr. (Fl. Brit. Ind. I, 499) and Cooke followed him. Gamble, however, put them under *G. cochinchinensis* Pierre (Fl. Madras 153).
There are too many intermediates between the two species to justify their being kept separate, though Haines finds them easily distinguished in his area. If it is a question of choosing *G. pentaphylla* or *cochinchinensis* the following list of synonyms will show that the specific name *pentaphylla* is older than *cochinchinensis*.

1. **Glycosmis pentaphylla** Corr. in Ann. Mus. Hist. Nat. VI (1805) 386; Graham Cat. 23; Dalz. & Gibs. Bomb. Fl. 29; Bedd. Fl. Sylv. Anal. Gen. XLIII, t. 6, f. 6; Hook. f. Fl. Brit. Ind. I, 500; Cke. I, 181.—*Limonia pentaphylla* Retz. Obs. V (1789) 24; Roxb. Corom. Pl. I, t. 84.—*Toluifera cochinchinensis* Lour. Fl. Cochinchinensis (1790) 262.—*Glycosmis arborea* DC. Prodr. I, 538.—*Limonia arborea* Roxb. Corom. Pl. t. 85; Fl. Ind. II (1832) 381.—*Mynospermum chylocarpum* Roem. Syn. fasc. I, 40.—*G. chylocarpa* Wight & Arn. Prodr. 93.—*G. triphylla* Wight Ic. t. 167.
Description: Cke. I, 181.
Locality: Common in the undergrowth of the monsoon forests of the Konkan, the W. Ghats and N. Kanara, often near streams and water-courses and other moist shady localities near villages.
Flowers: Throughout the year.
Distribution: In all districts of the Madras Presidency, Ceylon, tropical and subtropical Himalaya, up to 7,000 ft., Upper Assam, Malay Peninsula, Malaya, China, Borneo, Australia.

8. MURRAYA Koen. *ex* Linn. (Cke. I, 181).

Species 5.—Indo-Malayan.
Cke. gives 2 species; of these *M. exotica* must be called *M. paniculata*.

I. **Murraya paniculata** Jack in Mal. Misc. I, no. 5 (1820) 31; Dalz. & Gibs. Bomb. Fl. 29.—*Chalcas paniculata* Linn. Mant. I (1767) 68.—*M. exotica* Linn. Mant. II (1771) 563 (*Murræa*); Graham Cat. 24; Wight Ic. t. 196; Bedd. For. Man. in Fl. Sylv. p. XLIV *et* Anal. Gen. t. 7, f. 2; Hook. f. Fl. Brit. Ind. I, 502; Cke. I, 182; Gamble Fl. Madras 155.
Murraya Koen. according to the Brussels Congress is a retained name. *Camunium* Adans. (1763), *Chalcas* L. (1767), and *Bergera* Koenig (1771) are older.
See Tyozaburo Tanaka, *Chaclas*, a Linnaean genus which includes many new types of Asiatic types. In Journ. of the Society of Tropical Agriculture, Taiwan, Japan I (1929) 23-42.
Tanaka gives the following synonyms of his *Chalcas paniculata* L., (see l.c. 25):—*Murraya paniculata* Jack, Mal. Misc. i, no. 5 (1820) 31.—*M. exotica* Linn. Mant. pl. altera (1771) 563.—*Camunium exoticum* O. Kze. Rev. Gen. Pl. i (1881) 99.—*Chalcas exotica* Millsp. in Field Col. Mus. publ. iv (Bot. ser. i, no. 1) (1895) 25.—*Murraya sumatrana* Roxb. Hort. Beng. (1814) 32.—*M. exotica var sumatrana* Koord. *et* Valet. Bijdr. Booms. Jav. (1896) 4243.—*Chalcas sumatrana* Roem Syn. mon. (1846) 49.—*Murraya elongata* S. DC. *ex* Hook. f. Fl. Brit. Ind. i (1872) 503.—*M. banati* Elmer Leaflets Ph. bot. viii

(1915) 2812.—*M. heptaphylla* Spanog. in Linnaea xv (1841) 178.—*M. tavoyana* A. DC. *ex* Wall. in sched.—*M. chinensis* Pavon in sched.

Distribution: Throughout the hotter parts of India, Ceylon, China, Australia and the Pacific Islands.

2. **Murraya Koenigii** Spreng. Syst. Veg. ii (1825) 315; Cke. i, 182.

Locality: *Konkan*: Bombay Island (Blatter !); Salsette (Blatter !).—*W. Ghats*: Khandala (McCann !); hills near Poona (Woodrow !); Pasarni Ghat (Blatter !); Panchgani, common on slopes of Tablelands (Blatter !); Mahableshwar (Cooke, McCann !); W. of Belgaum (Ritchie).—*N. Kanara*: Supa district (Talbot).

Distribution: Madras Presidency: In most districts, chiefly in the N. Circars and Deccan, less frequent on the W. Coast; along the foot of th Himalaya, from Garhwal to Sikkim, up to 5,000 ft., Bengal, Pegu, S.-E. Asia. Often cultivated.

9. CLAUSENA Burm. f. (Cke. I, 183).

Species 20.—Palæotropics.

1. **Clausena indica** Oliv. in Journ. Linn. Soc. v (1861) Suppl. ii, p. 36; Cke. i, 183.

Description and Locality: Cke. l.c.

Distribution: Madras Presidency: W. Ghats, in evergreen forests of the Anamalais and Travancore, at 3,000-5,000 ft.; Ceylon.

2. **Clausena Wildenowii** Wight & Arn. Prodr. (1834) 96; Dalz. & Gibs. Bomb. Fl. 30; Wight Ic. t. 14; Bedd. For. Man. in Fl. Sylv. p. xlv, et Anal. Gen. t. 7, f. 3; Hook, f. Fl. Brit. Ind. i, 506; Cke. i, 183.—*C. pubescens* Wight & Arn. Prodr. 96.—*Cookia dulcis* Bedd. in Madras Journ. 1861; Trans. Linn. Soc. xxv, 211.

Description and Locality: Cke. i, 183.

Distribution: Madras Presidency: Carnatic, Salem, W. Ghats from Mysore through the Nilgiris to Travancore at low levels.

*3. **Clausena Wampi** Blanco.—*Cookia punctata* Sonner. Voy. Ind. iii, 258, t. 130.

Locality: Grown in gardens.

Distribution: A native of China (Chinese name Wampi).

10. TRIPHASIA Lour. (Cke. I, 184).

Species 1.—Tropics.

Cke. calls it *T. Aurantiola* Lour. The specific name *trifolia* is older.

1. **Triphasia trifolia** P. Wils. in Torreya ix (1909 33.—*Limonia trifolia* Burm. f. Fl. Ind. (1768) 103, t. 35, f. 1.—*Limonia trifoliata* Linn. Mant. ii (1771) 237; DC. Prodr. i (1824) 536; Graham Cat. 23; Dalz. & Gibs. Bomb. Fl. Suppl. 12; Hook. f. Fl. Brit. Ind. i, 507.—*T. Aurantiola* Lour. Fl. Cochinch. i (1790) 153.

Distribution: Probably a native of China. Cultivated and run wild in many parts of the tropics.

11. LIMONIA Linn. (Cke. I, 184).

Species 10.—Tropical Africa and Asia.

Cke. calls the only Bombay species *L. acidissima*. It must cede to *L. crenulata*.

1. **Limonia crenulata** Roxb. Corom. Pl. i, t. 86; Fl. Ind. ii (1832) 381; Gamble Fl. Madras 157.—*L. acidissima* Wight & Arn. Prodr. (*non* Linn.); Graham Cat. 23 (*non* Linn.); Dalz. & Gibs. Bomb. Fl. 29 (*non* Linn); Hook. f. Fl. Brit. Ind. i, 507 (*non* Linn.); Cke. i, 185 (*non* Linn.).—*Hesperethusa crenulata* Roem. Syn. fasc. i, 38.—Rheede Hort. Mal. iv, t. 14.

Gamble gives the following explanation of the above changes: '*L. crenulata* Roxb. Corom. Pl. i, t. 86 is the name which, as explained by Trimen in Journ. Linn. Soc. xxiv, 142, must be adopted for the plants recorded in the Flora Brit. Ind. under the name *L. acidissima* Linn., the actual specimens in Hermann's Herbarium, which are in leaf only, showing that they belong to *Feronia Elephantum*.' [Kew Bull. (1918) 223].

Locality: *S.M. Country*: Common in the Belgaum district: Gokak Falls (Dalz. & Gibs.); Padshapur hills (Graham).
Distribution: Bengal, Assam, W. and S. India (N. Circars, Deccan and Carnatic), Burma, Yunnan, Siam, Cambodia, Laos.

12. LUVUNGA Ham. (Cke. I, 185).

Species 4.—Indo-Malayan.

1. **Luvunga eleutherandra** Dalz. in Kew Journ. Bot. ii (1850) 258; Cke. i, 185.
Distribution: Bombay Presidency: Konkan, Ghats, N. Kanara; Madras Presidency: W. Ghats from S. Kanara and Mysore to Anamalais and Travancore up to 3,000 ft. in evergreen forests; Ceylon; Java.

13. PARAMIGNYA Wight (Cke. I, 186).

Species 6.—Indo-Malayan.

1. **Paramignya monophylla** Wight Ill. i (1840) 109; Cke. i, 186.
Distribution: Bombay Presidency: Konkan, W. Ghats, N. Kanara; Madras Presidency: N. Circars, W. Ghats from S. Kanara to Tinnevelly up to 6,000 ft.; Sikkim Himalaya, Bhutan, Khasia Mountains, Tenasserim, Ceylon.

14. ATALANTIA Corr. (Cke. I, 186).

Species 18.—Asia, China, Australia.
Cke. has 4 species. Brandis and Talbot are of opinion that *A. racemosa* is not specifically distinct from *A. monophylla*. Gamble, apparently with good reasons, keeps them separate. We follow Gamble and Cooke. We omit from Cooke *A. missionis* Oliv. He has not seen any plant and mentions only one locality 'ex Talbot'. Talbot, however, in his Forest Flora i (1909) does not mention the species at all.

1. **Atalantia monophylla** Corr.; DC. Prodr. i (1824) 535; Graham Cat. 23; Dalz. & Gibs. Bomb. Fl. 28; Hook. f. Fl. Brit. Ind. i, 511; Gamble Madras Fl. 159; Cke. i, 187.—*A. floribunda* Wight Ic. t. 1611.—*A. puberula* Miq. Ann. Mus. Bot. Ludg. Bot. i (1863-64) 211.—*Limonia monophylla* Linn. Mant. ii (1771) 237; Roxb. Corom. Pl. i, t. 82; Fl. Ind. ii (1832) 378.—*Turræa virens* Hellen. in Act. Holm. (1788) t. 10, f. 1 (*non* Linn.).—Rheede Hort. Mal. iv, t. 12.
Description: Cke. i, 187.
Locality: *Konkan*: (Dalz. & Gib.); Bombay Island (Blatter !).—*W. Ghats*: Khandala (Blatter !); Belgaum Ghats (*ex* Talbot).—*N. Kanara*: Moist forests (*ex* Talbot).
Distribution: Madras Presidency: N. Circars, Deccan and Carnatic in dry forests, W. Coast and W. Ghats. Foot of the Khasia Mountains, Ceylon, Malay Peninsula, China, Indo-China, Java.

2. **Atalantia racemosa** Wight & Arn. Prodr. (1834) 91; Cke. i, 187.
Distribution: Bombay Presidency: Konkan, W. Ghats; Madras Presidency: Hills of the Deccan, up to 4,000 ft., W. Ghats, chiefly on E. side from Mysore to Travancore, up to 3,000 ft.; Ceylon.

3. **Atalantia ceylanica** Oliv. in. Journ. Linn. Soc. v (1861) Suppl. 2, p. 25.
Distribution: Bombay Presidency: Phunda Ghat; Madras Presidency: W. Ghats in Wynaad, Malabar, Nilgiris, Anamalais and Travancore, up to 5,000 ft.; Ceylon.

15. CITRUS Linn. (Cke. I, 188).

Species 10.—Palæotropics and subtropics.
Of the 3 species mentioned by Cooke we retain *C. medica* and *C. Aurantium*, and change *C. decumana* into *C. maxima*.

3. **Citrus maxima** Merril Interpr. Herb. Amb. (1917) 296.—*Aurantium maximum* Burm. *ex.* Rumph. Herb. Amb. Actuarium (1755) Ind. Univ. [16].—*Citrus decumana* Murr. Syst. ed. 13 (1774) 580.
For interesting notes on the species of *Citrus* see:
Brandis.—For. Fl. (1874) 50.

Burns & Paranjpye in Poona Agr. Coll. Mag. May 1913, reproduced in Tropic. Agriculturist 42 (1914) 117.

Bonavia, E.—Cultivated Oranges and Lemons of India and Ceylon. London, 1890.

Chibber, N. M.—Morphology of Spines in Citrus. Proc. 5th. Ind. Science Congress (1918) clxxiii.

Lushington, A. W.—The genus *Citrus* in Ind. For. xxxvi, 323-353.

Guillaumin, A.—Les traveaux récents sur les Aurantiées. Rev. Bot. Applic. Agric. Coloniale 8 (79) (1928) 169-176.

16. Feronia Corr. (Cke. I, 191).

Species 1.—India to Java.

The name of *F. Elephantum* must be changed into *F. limonia*.

1. **Feronia limonia** (Linn.) Swingle in Journ. Washington Acad. Sc. iv (1914) 325-28.—*F. Elephantum* in Trans. Linn. Soc. v (1800) 225; Roxb. Corom. Pl. t. 141; Fl. Ind. ii (1832) 411; Wight Ic. t. 15; Graham Cat, 24; Dalz. & Gibs. Bomb. Fl. 30; Hook. f. Fl. Brit. Ind. i, 516; Cke. i, 191.

Distribution: Throughout India in dry situations from the Punjab eastwards and southwards to Ceylon; Java.

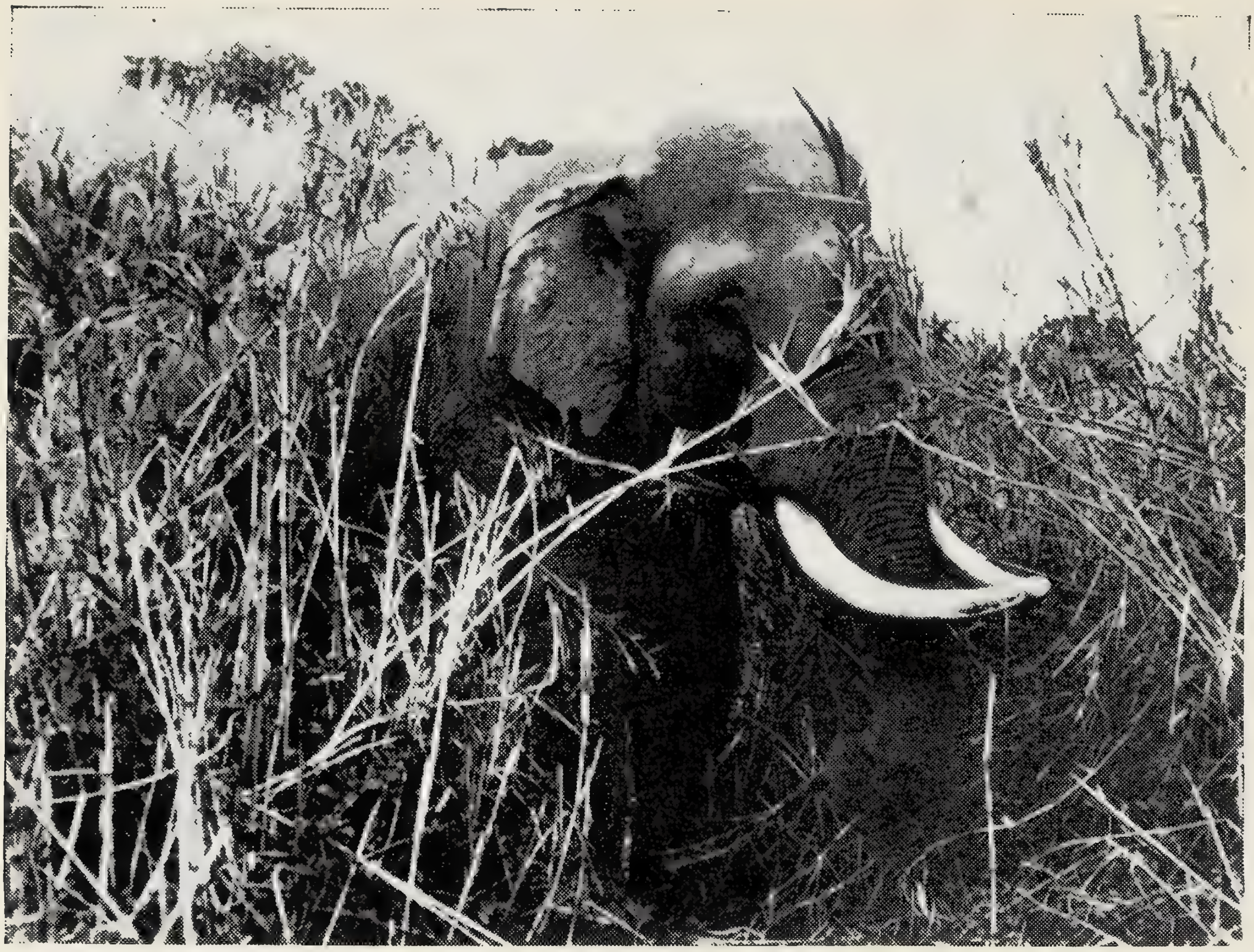
17. Ægle Corr. (Cke. I, 192).

Species 3.—Indo-Malayan.

1. **Aegle Marmelos** Corr. in Trans. Linn. Soc. v (1800) 223; Cke. i, 192.

Distribution: Throughout India, in dry hilly places, from the Jhelum to Assam and southwards to Travancore, wild or cultivated, or run wild, up to 4,000 ft. in the W. Himalaya.

(*To be continued.*)



A large tusker photographed in the Thayetmyo Yomah.

Elephants watering.

SOME EXPERIENCES AMONGST ELEPHANT AND THE OTHER BIG GAME OF BURMA FROM 1887 to 1931.

BY

W. S. Thom.

A book on big game shooting in Burma entitled '*Wild Sports of Burma and Assam*' written by me in collaboration with Colonel F. Pollock, late Staff Corps, was published by Messrs. Hurst & Blackett, Ltd., London, in 1900, priced at 16 shillings. Colonel Pollock sold the work outright to Messrs. Hurst & Blackett. I do not remember how much Pollock received from that Firm, but I received no portion of the sum paid to Pollock over the transaction.

bitter?

Messrs. Hurst & Blackett, on hearing from me that I was considerably out of pocket over the matter, were good enough to send me three complimentary copies of the work. Pollock, if he has not been gathered to his Fathers by now, must be well over 100 years of age. I tried without success to get in touch with him after he sold the book to Messrs. Hurst & Blackett and have never heard anything more of him since. That Pollock was a great *shikari* in his day and a remarkable man in many ways, and that he did an immense amount of big game shooting in the sixties, cannot be denied. I was asked on several occasions subsequently, when *Wild Sports of Burma and Assam* went out of print, as it cannot be obtained now easily, to bring out a new book of my own. That would have been a difficult business and would have cost more money than I could afford.

Big game shooting now-a-days is, I am afraid, very much decried. People look askance upon any one who may happen to have shot a few more animals than other people and refer to them as butchers. The filming and photography of wild animals in their natural state is now all to the fore. In my day, however, one could not go in for that sort of thing unless one had a big banking account, as cameras for that kind of work 25 and 30 years ago cost a mint of money. Cameras have, however, now been perfected to such a pitch, that this kind of hobby can be indulged in more easily, whilst they are not quite so expensive.

The Preservation of Big Game.

In the hey-day and first flush of my shikar days sportsmen did not think so much of game preservation as they do now.

There were no game preserves or game licences when I came to Burma in 1886, and many sportsmen did not worry so much regarding the numbers of animals shot by them provided the animals could be considered warrantable trophies, and nearly every sportsman tried to beat his neighbour so far as the size of the head or the length and weight of a pair of tusks were concerned, whilst he had also to consider the question of recouping himself for the expenses incurred and the cost of his weapons and ammunition etc. Now-a-days all that sort of thing is gone. A man who slaughters game for the sheer love of shooting and bagging animals is no longer tolerated. There is no doubt of course that we all to some extent inherit in our breasts the savage instincts of our forefathers. A great deal has been written and is still being written and done on the subject of big game preservation everywhere; but so far as I can see little or nothing can be done to stay the final destruction of all big game not only in this Province but in India and in Africa. The spread of civilization, the motor car, the modern high powered rifle, new roads, the woodman's axe, the Arms Act and Rules, electric contrivances for night shooting, poaching by people of the country and the fact that the Forest Department is understaffed, are all factors which are now slowly but surely tending to bring about the steady diminution of game. It is of course admitted that the necessities of civilization must come first in the scheme of things and the preservation of fauna must take second place.

The European hunter makes little impression on wild life. He is usually a keen sportsman or else he would not hunt in the feverish localities he visits in search of big game. The native hunter is in quite a different category. The difficulties of bush and climate do not thwart him. But why go on; one could write pages on this subject. The fact that such animals as the Malayan Tapir (*Tapirus indicus*) which, so far as this Province is concerned, is only found in Tavoy and Mergui, and the Rhinoceros, two species, (*Rhinoceros sondaicus* and *Rhinoceros sumatrensis*) are now entirely preserved, may retard for some years the process of extermination so far as they are concerned. I think I shall not be wrong in stating that the only Tapir and Rhinoceros of Burma that we shall see finally will be animals that have been preserved in Zoos or in Museums. This in my opinion is the order in which animals in Burma are likely to disappear as the years roll on; (1) Tapir (*Tapirus indicus*), (2) Rhinoceros (*Rhinoceros sondaicus* and *Rhinoceros sumatrensis*), (3) Thamin (*Cervus eldi*), (4) Hog Deer (*Cervus porcinus*), (5) Tsine, i.e. the Banting (*Bibos sondaicus*), (6) Bison or Gaur (*Bibos gaurus*), and (7) Elephant (*Elephas maximus*). The *Felidae*, i.e., tigers and leopards, which one might include as big game, will also disappear when large areas of land become thickly populated, causing a subsequent decrease and thinning out of forests and undergrowth owing to the great demand for fuel, and as cultivation spread with consequent diminution of all the remaining deer tribe such as Sambar (*Cervus unicolor*), Hog Deer (*Cervus porcinus*), Barking Deer (*Cervulus muntiacus*) and Mouse Deer (*Tragulus javanicus*). Serow or the Burmese Goat-Antelope (*Nemorhaedus sumatrensis*) and Goral (*Cemas goral*), which are generally found in precipitous rocky localities, will probably be the last to disappear, as they are not easily got at except with low-trajectory, small-bore rifles, which the majority of the people of this country fortunately do not possess. I would be inclined to protect Serow altogether, as in some places they can be easily beaten out of cover and shot with ordinary 12-bore shot guns with cartridges loaded with buck shot. All the bird life of the country is being rapidly thinned out. Some birds are shot and some snared by the people for food, whether they be egrets, Imperial pigeons, hornbills, Sarus cranes, paddy birds or beef-steak birds.

Crows, parrots, vultures, owls, sparrows, hawks, and perhaps doves and green pigeon will probably outlast the rest, with snipe, teal, duck, woodcock and geese coming next. Peafowl, pheasants, jungle fowl, partridges and quail will last till no cover for them exists. When I first came to Burma in 1886 I have seen the horizon in some districts white with egrets, herons, ibises and other waders and water birds. There are very few places indeed now where this can be seen. Snipe and all water birds are being snared wholesale all over Burma. I have not mentioned pigs. No one bothers much about wild pig. They multiply rapidly and are good eating. Besides, they do much harm to the crops of the people; as do parrots and monkeys. It really does not matter what becomes of them.

With regard to Big Game, in the year 1902 I saw on the Pidaung Plain, Myitkyina, one morning all within view at the same time within 300 yards of where I was seated on an elephant, a herd of about 100 Hog Deer, 40 Bison and the same number of Tsine. It was a glorious sight. The Pidaung Plain is now a sanctuary and is being carefully guarded by the Forest Department but no one I fancy will ever see the same sight again regardless of preservation as the Kachins as well as the Gurkhas do a lot of poaching still at odd times, and when Burma gets its new constitution will things get better or worse? We are all bound down now-a-days, and rightly so, by strict Game laws, and are compelled to shoot only one or two of each species of game.

The Elephant.

Much has already been written on the elephant by experienced sportsmen, who have shot in Africa, in India and Burma, as to how and where to shoot elephants and the kind of rifle to use, but in case some of my readers have not studied the books of such famous elephant hunters as F. C. Selous, Newman, Sutherland, Stigand, Bell, Burton, Sanderson, Chapman, Kirby, Rainsford, Court-Treatt and a host of others, I shall discuss the matter here again as clearly and as briefly as possible. I am entirely in agreement with Major C. Court-Treatt, author of *Out of the Beaten Track*, when he says, 'assuming that the purpose of all sport is the attainment of adventure and the exercise of skill, I dare to maintain that elephant hunting can legitimately be regarded as the greatest of all sports; and, since only the elephant hunter is qualified to dispute it, my assertion is not likely to meet with any great volume of dissent. Adventure there is in plenty and hard work too; and the hunter needs to be highly skilled in the habits and anatomy of the animal before he can be enrolled into the spiritual membership of elephant hunters'.

I fancy I have encountered in my wanderings in the jungles of Burma during the last 45 years more big game than has fallen to the lot of most sportsmen. I trust also I may be pardoned for remarking that my knowledge of the elephant, its habits, and its haunts, and how to track it, where to fire at it, and the kind of weapon to use, is perhaps as good as that of any other European sportsman in the East. The best time of the year for tracking elephants is during the rains, when the ground is soft and their tracks are more easily followed, especially when they are feeding in bamboo jungle. As a rule the animals possessing the best tusks are solitary, but a monster with very fine tusks is sometimes found leading a herd or on the outskirts of a herd. I found it much easier to follow up the tracks of a solitary tusker elephant than to stalk into a herd with the object of picking out an animal with the best tusks. As often as not, a slant of one's wind or scent is obtained by some member of the herd, usually a female, or a young tusker, when a warning is given, and the whole herd either slips quickly and quietly away, or stampedes without giving the hunter a chance for a shot. Woe betide the sportsman if the stampede is in his direction, as sometimes happens, if he cannot get behind a decent sized tree or bamboo clump in time. The danger of a stampede is that he is liable to be confronted by some infuriated cow elephant with a calf or some bull possessing small tusks or some cantankerous 'muckna' or tuskless male. On these occasions he may have to shoot in self-defence, when the usual report will have to be made to the Forest Department, which will probably fine him, and if a tusker, annex the tusks. The easiest way out of the difficulty where a herd of elephants in a panic stampedes towards you, is to stand perfectly still behind a tree, or bamboo clump, as their sight is far from good, and take the risk of their passing you without having seen you; or, if they do happen to see you, there is always the chance that they will hurry on all the more quickly to avoid you. On the other hand, I have known of herds of elephants to charge deliberately in a body towards the sportsman on scenting him, without having been disturbed in any other way, but they were generally herds that had been harassed a great deal by being frequently fired on by persons armed with inferior weapons. The danger is then very great, and unless the sportsman's nerves are in good order and he has also had long experience with elephants, he should contrive to get out of their way as quickly as possible either by climbing a tree or by making a clean bolt for it. There is no mistaking the sounds emitted by a herd of elephants that means business as it comes charging, shrieking and trumpeting along. A succession of angry screams and trumpetings will be emitted first, which will convey the warning and the sounds of thumping feet and the breaking of branches will then follow. The sportsman's Burman hunters, if they have not already made themselves scarce by ascending the nearest trees, as they are sometimes inclined to do, should be able to warn him of the danger and advise him what to do and which direction to take. Elephant shooting is easy enough if you have good eye-sight, are fleet of foot, and know how to shoot straight, and above all are using a good rifle. The latter is about as important as all the rest put together. In the good old days

I made a point of never following the tracks of a solitary tusker elephant unless these measured 18 or 20 inches from toe to heel. I refer only to impressions of the forefeet. There is no mistaking the elongated tracks of an old tusker elephant. The cracks and wrinkles on all four soles of the feet and the large toe nail indentations on the soft ground are also usually clearly defined. The length and thickness of an elephant's tusks may be indicated by the cavities he digs in the soft earth of stream banks as he moves along or by the marks left by his tusks on the ground where he has passed the night. A solitary tusker usually sleeps on his side flat on the ground like a horse with all four legs stretched out straight. I remember once coming across a solitary bull elephant asleep on the ground which was making use of an ant heap as a pillow. The dung of an old elephant is also generally of a coarse texture and fibrous looking. Tuskless male elephants, called by the Burmans 'haings' or 'hines' and by Indians 'mucknas' are generally big fellows with powerful trunks. A big 'muckna' is usually feared by the members of any herd to which he may belong and he is a very dangerous animal when he becomes a rogue and turns solitary. As a rule there is no mistaking the tracks of a 'muckna' or 'haing' for they are generally more circular and less elongated than the forefoot impressions of a tusker. No sportsman ever shoots or is permitted to shoot a female elephant in India or Burma unless compelled to do so in self-defence, simply because, unlike the African species, they carry no tusks.

E. G. Boulenger rightly says that an animal's sense of smell is usually, although by no means invariably, gauged by the development of its nose. Elephants have a very keen sense of smell. The power of an elephant's trunk is enormous and with it the animal can lift a ton with ease. Though immensely strong, such a trunk has its own peculiar dangers and its care is a matter of constant vigilance and anxiety to its owner. If threatened by a tiger it is curled up over the forehead. Still more dreaded is the poisonous snake. The common mouse, whose holing instinct may lead him to take refuge in one or other of the large nostrils, is likewise a danger. When charging, an elephant, on being wounded, comes tearing along at a great pace, faster indeed than most people would give it credit for being able to travel, and when the animal has really got into his stride he can overtake the fastest runner in the world after the first hundred yards or so, but he trusts to his keen sense of smell more than anything else to overtake his enemy—man. To escape from a charging elephant, it is not safe for a hunter to run in a straight line for any distance, for he has a better chance of eluding the animal by going off at right angles, especially if he is running up wind, that is to say, if his scent is being carried towards the approaching elephant. The screams of an infuriated, wounded, charging elephant are terrifying, and awe-inspiring in the extreme, and woe betide the hunter, if he trips and falls or is overtaken, for he would be pounded into pulp and every bone in his body would be broken. An elephant usually seizes a human being with his trunk and dashes him against the ground or against his own knees, and then flings him away into the air or strikes him a terrible blow with his trunk. Sometimes he kicks his victim with his forefeet, or, after seizing him with his trunk, throws him to the ground and kneels upon him, if he does not drive his tusks through his body. In nearly every case a fatal injury is inflicted.

An elephant cannot take all four feet off the ground in a jump, like a horse, to negotiate say an eleven or twelve foot ditch. A man escaping from a charging elephant can therefore jump over an eleven or twelve foot wide ditch or nullah, and be quite safe on the other side, for it would not be possible for any elephant to negotiate it in its stride. In other words, an elephant cannot cross a deep ditch that is beyond the compass of its stride. It would, of course, be possible for the elephant following a man under these conditions to go down into the nullah and up the other bank, but that would give the hunter time to escape. The hunter should also see, in the event of his getting behind the trunk of a tree or bamboo clump to escape from a charging elephant, that it is large and thick enough to withstand the impact of an elephant's charge, for an elephant is able to knock down any ordinary sized tree and will go through a fair sized clump of bamboos like paper.

The secret of success in elephant shooting is to get as close as possible to the animal and make sure of the first shot, if possible, intc the brain. When a clear view of the brain is not possible, a shot behind the shoulder to reach heart or lungs should be taken. If both lungs are perforated by a heavy bullet propelled by a big charge of cordite, say 100 grains from a ·577 cordite rifle, the animal usually will not survive, but he will have to be followed for several miles in the case of the lung shot before he is rendered helpless by internal haemorrhage. Sanderson, the author of the work *Thirteen Years Amongst the Wild Beasts of India*, says—'the head shot is the poetry and the body shot the prose of elephant shooting'. An elephant's brain can be found by (1) shooting a little above the bump from in front; (2) and (3) by shots fired in the temple hollows on either side of the head from left or right half front; (4) by a direct shot at right angles from the side into either ear hole; or (5) by a shot from a little behind the ear when the ear is thrown forward. Then there is (6) the heart shot. The heart, shaped like a small rugby football, lies low down between the shoulders. This shot should be taken from a little behind, when the animal moves a foreleg forward, at the height of the elbow-joint of the leg. Some sportsmen, in order to make absolutely certain of bagging an elephant with really fine tusks, rely entirely on the lung and heart shots, for, in a head shot, unless the brain is reached by the bullet, the animal will not die, as there are no big arteries in an elephant's head and he will usually go clean away if he does not turn and charge. An elephant, when followed and approached after a shot or two through both lungs, if he is disabled, will be found generally standing stock-still with blood pouring out of his trunk, which will generally be up in the air and then he can be easily finished off. It is only when an elephant dies, or is at the point of death, that he lies down, and, as often as not, when shot through the brain, he collapses on to his knees and remains in that position without toppling over. If an elephant should enter a stream and drink water after he has received, say a couple of shots through the lungs, he will become more quickly disabled. I have known solitary tuskers with only one tusk, when shot through the brain, to topple over on to the ground on the tusk side. Burman hunters emphatically state that elephants with two tusks, when shot through the brain, will fall to the ground on the side which carries the heavier tusk.

Elephants have been known to plug up with mud the bullet wounds received in their bodies in order to keep them from becoming fly-blown. It is also well known that elephants indulge in mud baths and plaster themselves all over with mud in order to protect their sensitive skins against the attacks of gad flies and even mosquitoes towards the beginning of the rainy season, i.e., April, May, and June. At this season all large dangerous game become more irritable from the stings of insect pests. The brain of an Asiatic elephant is more easily reached by the bump shot from in front, than is the case with the African species. It is not generally known that the back of the Indian elephant (or Burmese elephant) is convex, whereas in the African species it is concave. The Indian or Asiatic elephant again possesses only one lip or finger-like process at the end of its trunk, whereas the African species has two. The trunk of the Indian or Asiatic elephant is also less strongly ridged than that of the African. The Indian elephant's face, too, is plumper and altogether milder in expression and lacks the lean aggressive appearance of that of his African brother. The African elephant is taller by a foot, weighs more and carries heavier ivory. It is also interesting to note that the Asiatic elephant has four or five toe nails on each hind foot in contrast to the three toe nails possessed by his African twin.

Rifles for Elephant Shooting.

When I first started big game shooting in Burma I used a double barrelled 8 bore hammerless ejector paradox gun burning a maximum charge of 10 drachms of black powder. I found a weapon of this sort very effective indeed. Now-a-days no one ever thinks of using heavy weapons of this description because of the weight and the smoke from the black powder, which was often blown back into one's face, thus temporarily shutting off a good view of the animal fired at. Nevertheless, I did very good execution with it and was loath to exchange it for the more up-to-date and modern cordite rifles. A good 'big un' is of course much better than a good 'little un', and I must say I very seldom found the 8 bore fail me, as the heavy conical bullet usually delivered such a shock to the nervous system of an animal such as elephant, bison, or tsine, when tearing its way through the flesh, muscles, tendons and bones, as to cause temporary paralysis. I have on several occasions fired, raking shots, with the 8 bore from behind through the small of the ribs at a solitary bull bison standing 20 hands at the shoulder, which has caused the animal to lurch forward a few yards and then collapse. Even if a fatal shot had not been fired, say through the heart, brain or neck, the animal which had received the raking shot through the small of the ribs was usually rendered *hors de combat* for the time being. I was then invariably able to walk up and administer the *coup de grace* from a distance of only a few paces. There were occasions also when even the 8 bore failed me; but show me the sportsman who has not had similar disappointments with any and every kind of weapon. Sutherland, the famous elephant hunter of Africa, who accounted for over 500 elephants in his day, sometimes failed to stop charging elephants using a double barrelled ·577 cordite rifle burning 100 grains of cordite—a weapon I have used occasionally myself in recent years, but with not the same success as I obtained with the good old 8 bore. In Burma, where the jungles are dense, a knock down blow has often to be delivered at a distance of only a few yards. When one is young and in good training neither the weight of the rifle nor the recoil is felt. One certainly feels the recoil of a big rifle more when one fires for practice at a mark on a tree, but when one pulls trigger on an animal you hardly notice it at all in the excitement of the moment.

It is amusing to listen to some of the youngsters who, having been out only a year or two in the country, have gone out after large and dangerous game, such as bison and elephant, armed with small-bore rifles such as a ·303, or ·380 magazine Ross rifle, or a ·256 bore Manlicher. Some of them have even been successful at their first attempts, but they had not to follow up a wounded animal subsequently. This was an experience they were fortunate enough to escape. Ignorance is bliss, etc. Some of the best-known big game shots of Africa have, it is true, used small-bore rifles, such as ·303, ·318 or even ·256 bore, on elephant successfully, but the majority of these men have been seasoned veterans at the game and, besides being excellent shots, knew where to plant their bullets with deadly accuracy, and, last but not least, they invariably had a gun bearer carrying a second weapon which was usually a heavy high velocity rifle, such as a double ·450 or ·500 bore cordite rifle as a stopper in case of a charge. If I were asked by some would-be sportsman what sort of rifle I would recommend him to get for shooting big game in Burma my reply would be 'What kind of animal do you want to shoot, and what can you afford to pay?' Another factor to consider is the height, strength and activity of the would-be sportsman. If he is a strong man and can carry a heavy rifle and intends shooting dangerous game such as elephant, bison, tsine, i.e., wild cattle, and tiger, and has moreover a good bank surplus, I would then immediately suggest his getting a double-barrelled hammerless cordite ejector rifle of any of the following calibres, viz., ·500, ·470 or ·450. These burn 70 or 80 grains of cordite. The best double bore rifles are made in England by any of the following firms, who are makers of repute, viz., Westley Richards, Holland and Holland, Gibbs of Bristol, Jefferey Greener, Cogswell and Harrison. As a second weapon, he could purchase a magazine magnum

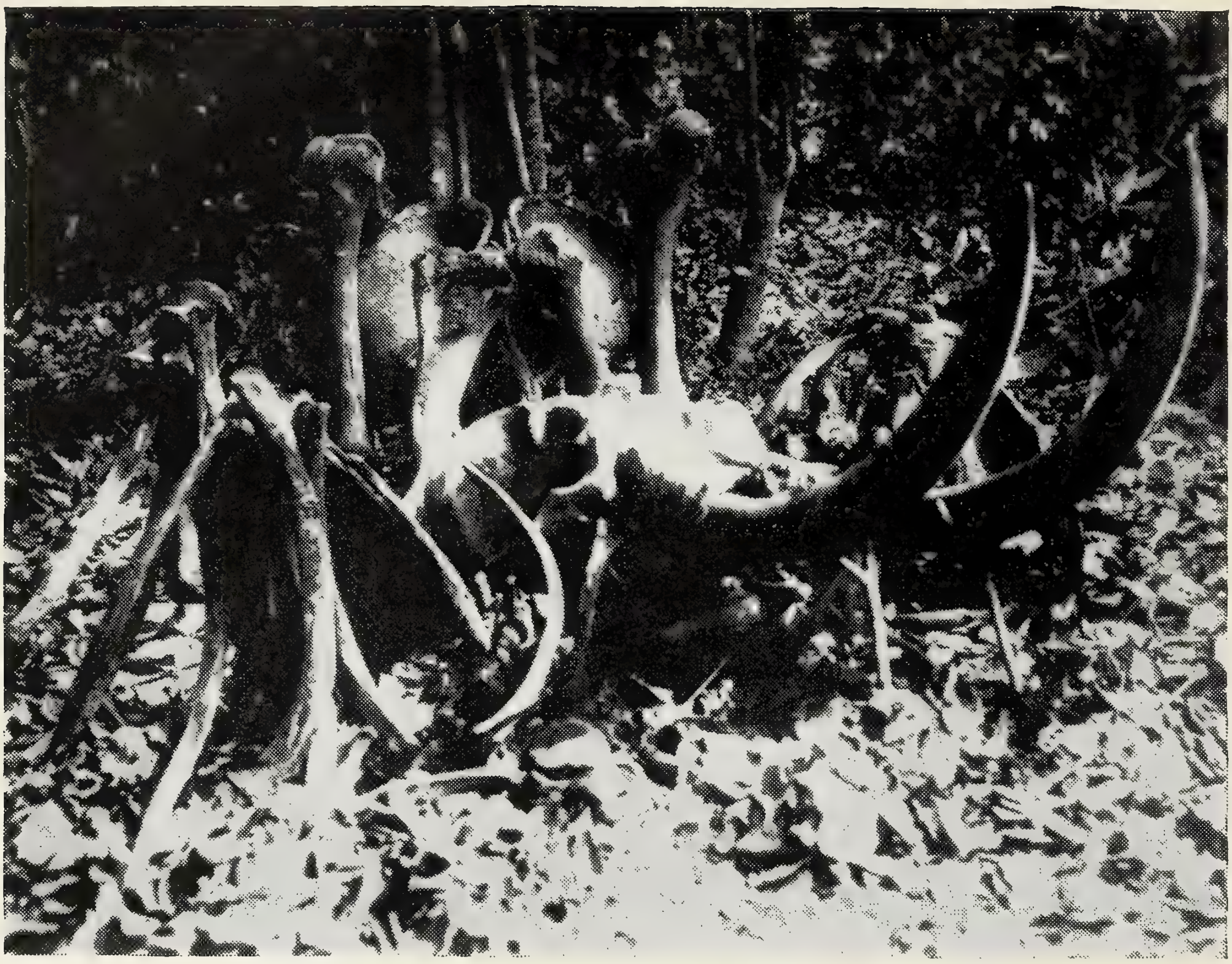
·375 bore cordite rifle or a magazine ·333 or ·318, any one of which is powerful enough for all thin-skinned non-dangerous game and which would be useful also for finishing off a wounded beast. For beats when tiger, leopard, bear and Sambar may be driven out by village beaters, a double 12 bore magnum 'Explora' cordite rifle by Westley Richards cannot be beaten. High-velocity small bore rifles should not be used in a beat. If I am asked to join a party of sportsmen in a beat and find that one of them intends using a small bore rifle, I contrive to place between him and myself the biggest tree trunk I can find in the locality, before the beat starts. A bullet from a small bore high velocity rifle has a nasty way of ricochetting all over the place even if it does succeed in striking the animal, as it invariably passes clean through it. An ordinary double 12 bore shot gun, chambered for 3 inch cartridges, loaded with solid spherical or lethal ball, L.G. or S.S.G. slugs would be another useful weapon for despatching an animal at close quarters. A poor man will find there are many useful magazine rifles on the market which can be picked up even secondhand, for two or three hundred rupees or less, such as a ·404, ·423, ·318 and ·375. It is much easier, however, to align the sights of a double barrelled rifle than those of a single barrel magazine rifle.

Dead Tusker Elephants Found in the Jungle.

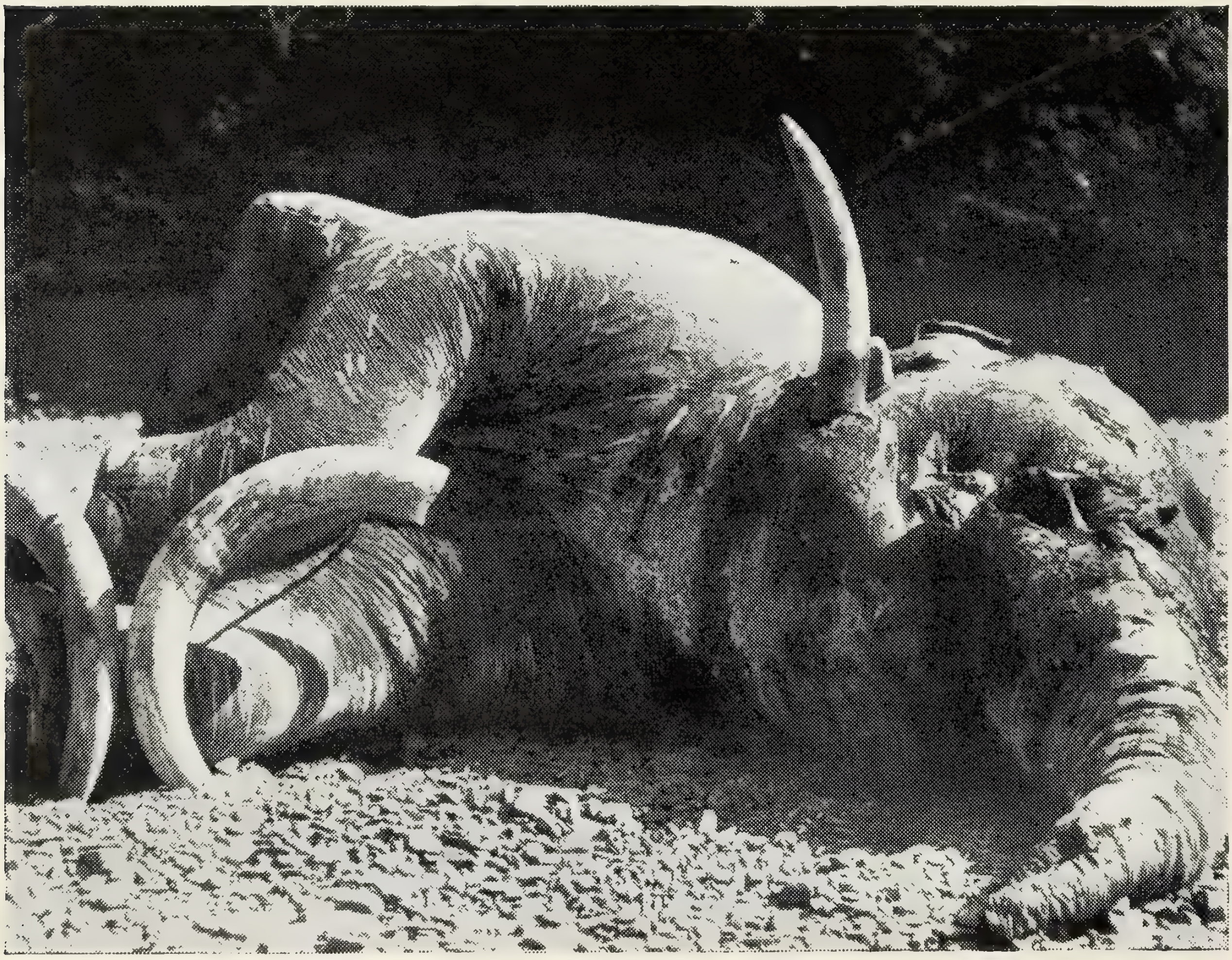
A wealthy American who had done a great deal of shooting in Africa and in other parts of the world asked me whether I had ever found animals in the jungle at the point of death, or which had died from natural causes, or any animal cemeteries. My reply was that in the whole of my experience which extended over a matter of 45 years I had never done so, and I suppose I would almost be quite safe in saying that it would be possible to count on the fingers of one's hand the European sportsmen who have done so, although they may have roamed through all the forests of the world for years. I have come across the remains of serow, a species of goat-antelope, barking deer and sambar, that have been killed by leopards or tigers, but never any animal that was at the point of death or had just died from natural causes. What becomes of all the animals that die from old age or disease is a conundrum that has been asked many times.

In the *Rangoon Gazette*, some years ago, I wrote an exhaustive article on the subject of 'Where do elephants die, and animal cemeteries'. It would take too long for me to go into this subject again here as fully as I did then. It must not be imagined that because an elephant is such a huge beast the carcase or skeleton will remain visible above ground for years, like the vulture- or crow-picked skeleton of a camel, mule or horse, that may have perished in an arid desert where the rainfall is practically nil and where the absence of jungle and undergrowth, not to speak of animal and insect life, preclude its disappearing for a very long period. It is a very different matter in tropical countries like India and Burma, where all organic matter tends to decay rapidly and where the jungle is usually alive with insect and animal life. The carcase of any dead animal very soon disappears owing to torrential rains, swollen streams, white-ants and a host of other insects, dry rot, damp rot, and the heat of jungle fires, the ceaseless gnawing of the remains by a multitude of large and small animals. It should not be forgotten also that the skull and bones of an elephant are full of oil and will burn rapidly in a jungle fire. Is it to be wondered at then that the remains of even such large animals as elephant, bison, rhinoceros and tsine are seldom encountered?

Some years ago, under rather peculiar circumstances, I found the remains of two wild tusker elephants both of which had met their deaths in fights with other tuskers. In the first case, I was fishing for mahseer in the Lemro river of Arakan in the unadministered territory of the Arakan Hills Tracts, Burma. Noticing a stale odour emanating from a neighbouring thicket some 300 yards or so away, I asked one of the two Chin boatmen who were with me to go and see what had died, as he might perhaps find that a sambar or a bison had been killed by a tiger, in which case there would surely be the head and horns. The boatman, however, declined to go, saying he was afraid of meeting a leopard or a tiger, so putting my rod down and picking up a magazine ·355 Manlicher Schoenaur rifle that I always carried on these occasions in case of meeting barking deer and pig, I walked off towards the thicket, nosing up the smell as I moved along, the wind being right. After travelling about 600 yards or so I found the remains of a tusker elephant in an open glade with thick jungle all round. A tusk was still sticking in its socket in the skull whilst the other tusk was lying on the ground beside it. The ribs and bones of the animal were lying scattered about in the vicinity in all directions, and the tree trunks close by were marked with the claw marks of tigers and leopards that had cleaned their claws there after regaling themselves night after night on the flesh. The skull and all the bones were bare of flesh of course, for the animal had been dead at least six or eight months. The photograph of the remains, shown in Plate II, was taken after I had put together all the remains, done a little jungle clearing to let in the light, and inserted the second tusk into the empty socket of the skull. It seemed marvellous to me that the tusks of the dead animal had not been taken by some of the wild Chin tribesmen, but I learned that they were afraid to go into clearing where the remains of the dead animal lay as a really bad type of 'Nat' or spirit of the woods resided there. I tried to picture to myself how the animal had come by its end and was told finally on my return to camp that evening that the Chins from a neighbouring village had heard two elephants trumpeting and roaring, in the jungle about a mile or so above the spot where I had found the remains and that the animal to whom the remains belonged had probably been vanquished in the fight by being gored to death by the other tusker and then mortally wounded had come into the thicket to die, as it was a quiet locality and near water. In the second case, I was out after bison (gaur) and rhinoceros along the banks of a certain stream in Arakan when



Elephant remains near the Lemro River, Arakan.



A carcase of an elephant killed in a fight. The broken tusk of his antagonist which was embedded in his skull is shown in the photo.

my attention was attracted by a strong odour of decaying meat, more pronounced than in the case of the last dead animal found by me. It took me about ten minutes to reach the spot from whence the stench emanated and, when I turned a bend in the stream, I was thunderstruck at seeing a magnificent dead tusker elephant in a kneeling position in the gravel bed of the river, with its head up clear of the ground, and a magnificent pair of tusks protruding straight out of its mouth. A number of jungle fowl, cocks principally, some eight or ten birds in all, were running about backwards and forwards over the body eating the maggots that crawled about on it. The smell was pretty overpowering, but being accustomed to that sort of thing from a long sojourn in the jungle, my stomach did not fail me. I went up and examined the animal thoroughly and noticed that it must have been killed by another tusker in a fight, as there were several deep stab wounds on either side of its neck and body, which had evidently been inflicted by the tusks of another elephant. Unfortunately my camera was in camp some miles off and it was not till my men had extracted the tusks of the dead animal, which weighed 84 lbs. the pair, that it turned up and I was able to get two or three photographs of the dead elephant. It was while I was superintending the extraction of the tusks that I found, purely by accident, the remains of another broken off tusk, 27 inches in length, weighing 18 lbs., deeply embedded in the skull of the carcase and sticking out from under the palate. The broken off tusk had passed through the skull into the brain. Judging from the faint black circle round the tusk near the spot where it had snapped off short, it was apparent that it had broken off at the lips of the animal which won the fight. It was a unique discovery for I do not suppose such a find has ever been recorded before. All the bushes and gravel in the vicinity, I then noticed, had been trampled upon, torn and scattered about in all directions. A portion of the hind quarters of the dead elephant had been eaten by a bear whose feet impressions showed up clearly on the soft wet sand by the side of the stream. Quite recently, I heard the story of the fight which had taken place between the two animals, and recorded it in detail. It seems that a Chin from a neighbouring village some four or five miles away had come down with his wife to the stream to fish, and had caught sight of the elephant which was subsequently killed, drinking at the stream at about 5 p.m. He and his wife on seeing this immediately ascended a tree for safety, being in a mortal funk, as the elephants in that locality were given to chasing and killing people. Some five or ten minutes after this another tusker elephant with shorter and straighter tusks came out of the jungle some sixty yards or so to the rear of the animal which was drinking. The latter immediately spun round and with lowered head faced his opponent, who, uttering a shrill trumpet, rushed forward in full charge, the two meeting head on with a terrific crash. Both animals then engaged each other with their trunks holding up their heads, and manœuvring for position. The younger animal then disengaged himself and backed for a distance of about twenty yards. The elephant that was vanquished subsequently then also started to wheel round as if to clear out, for he was at least fifty years older than his opponent, when the other elephant put on a spurt and, rushing forward, delivered a succession of deadly stabs into both sides of the neck of the older animal. Just at this time, some five or six female elephants accompanied by one or two calves appeared on the scene from the jungle, but kept at a respectable distance, squeaking occasionally as if in fear. The older elephant. whose tusks were blunter and more curved and in consequence not at all suitable for stabbing purposes was placed at a considerable disadvantage. The younger tusker, whose tusks must have weighed about 50 or 60 lbs. the pair, but were straighter and more pointed, as can be seen from the photograph of the gouge and tusks of the dead animal with the broken-off tusk called 'Manswe' by the Burmans, lying in front, simply made circles round his less active and older opponent.

It then appears that the younger animal in a final charge from in front met its opponent head-on and embedded, up to the lip, its right tusk in the skull of the older animal. When they parted company it was seen that the younger animal was minus his right tusk. The old tusker then standing stock-still for a few seconds suddenly threw up its trunk in the air and gradually subsided on to its knees, in the same position as a tame elephant, when about to take up his mahout on its back. What would I not have given to have been there with a cine camera to witness this battle of the giants? I have been told by the Burmans that so long as the broken off tusk, the 'Manswe', remains in my possession no harm can ever befall me, and that I shall always have the best of luck. I have had numerous requests from Burmans and Shans to sell them the 'Manswe' outright, if I will not give them a chip of it, but, as I have always pointed out to those making the requests, that, according to their own beliefs, it would be wrong of me to do so as it would bring me bad luck. So there it lies, still intact, in the hall of my house beside the tusks of the victim whose spirit doubtless roams the Elysian fields or the forests of Valhalla.

The literal translation of 'Manswe' in Burmese is, I suppose, 'Man' which means temper and 'swe' which means the tusk, or in other words 'The tusk that in a temper did the damage'.

The photograph of the dead tusker which looks as if it is about to topple over a 'kud' or precipice is true in actual fact. I had wounded this animal behind the shoulder and followed him up for five miles. He went into a dense cane brake in the Thayetmyo Yoma mountains between Thayetmyo and Arakkan and waited there in grim silence for me, to come up with him, without even advertising his whereabouts by a flap of his ear.

Cautiously, Oh, ever so cautiously, did I push my way into that cane brake, and only those who are accustomed to the jungles of Burma will know what is meant by a cane brake and how difficult it is to move about in one without being hung up or even seeing clearly fifteen yards ahead. To cut a long story short, I almost walked into him as I rounded a bamboo clump, and without a note of warning, except for the emission of a suppressed spurt of air which he shot out of his trunk, he raced straight in my direction. I made half a dozen flying leaps to avoid him but came an awful sprawler, tripping over a cane and spread-eagling right in his path. Fortunately for me the jungle was very dense overhead or else he would have spotted me lying helpless beneath him. As he came tearing along through the undergrowth one of his ponderous forefeet found my right thigh and pinched half of it into the mud without breaking a bone or doing any damage except to cause me to utter a slight groan of pain on account of the bruise which turned my right thigh into all the colours of a rainbow. I followed him up within an hour and came up with him again after he had covered about three miles of very hilly country. This time, he was head on to me in fairly open jungle. On catching sight of me he uttered a shrill trumpet and swung round as if to make off, but not before I got him with a lucky shoulder shot through the heart. He went about thirty yards before collapsing, and all but went over a steep 'kud', remaining balanced on the top. I was only able to photograph him from above. His tusks weighed 95 lbs. the pair and I noticed that one of his forefeet, the right one, was much smaller than the left.

The photograph of the large wild tusker which was taken in the Thayetmyo Yoma hills is perhaps one of the finest photographs, ever taken of a wild tusker. He was coming out of high elephant grass and, as there was a deep ten-foot wide nullah, in between, a few yards only separated us. The lens used was a 17½ inch Ross' Telecentric, a perfect picture being obtained. It may be asked why I did not shoot this fine specimen. My reply is that I had shot quite a number already and would much rather have the photograph I obtained. I had a heavy rifle with me at the time which was being carried by a very faithful staunch old hunter of mine Maung Tha Yauk by name, who never once let me down on all the numerous occasions on which he accompanied me into the wilds, and who has not long since gone to *Nirvana*. May we meet again in the Elysian fields of that mysterious land about which we talk such a lot but know nothing, to relate there all over again the details of the many hairbreadth escapes and encounters we shared together. Will I ever see his equal again? To Tha Yauk, one of the finest hunters, trackers and characters it has ever been my good fortune to know, I owe much of whatever success I have attained in the pursuit of Big Game.

THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS.
(ORNITHOLOGICAL SECTION).

BY

Hugh Whistler, M.B.O.U., assisted by N. B. Kinnear, M.B.O.U.

PART IV.

(*Continued from page 93 of this Volume*).

Lanius vittatus Valenciennes.

Lanius vittatus Valenc., Dic. Sci. Nat., xl (1836), p. 227—Pondicherry.

Specimens collected:—102 ♂ 21-4-29, 111-112 ♀ ♂ 22-4-29 Kurumbapatti; 555 ♂ 558 ♂ juv. 19-7-29 Gingee; 755 ♀ 26-8-29 ♀ imm. 27-8-29 Palkonda Hills 500 ft.; 808 ♂ juv. 12-9-29 Kudur; 880 ♂ 5-10-29, 882 ♀ 6-10-29, 891 ♂ juv. 892 ♀ 8-10-29 Seschachalam Hills 2,000 ft.; 1063 ♀ imm. 8-12-29 1102 ♀ 13-12-29, 1106 ♀ 1108 juv. 14-12-29, 1143 juv. 19-12-29, 1147 ♀ imm. 1148 ♀ 20-12-29, 1187-9 ♀ ♀ ♀ 28-12-29 Cumbum Valley; 1472 ♀ 4-3-30, 1580-A 4-3-30 Sankrametta 3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
6 adults ♂:	15 -17.5	82-88.5	81-96	21.5-24 mm.
3 immature ♂	14.5-16	79-85	75-81.5	21-23 mm.
11 adults ♀:	15 -17.5	82-87	81-87	21.5-23 mm.
3 immature ♀:	16	79-81.5	78-80	20.5-22 mm.

(Immature includes both juveniles and first winter birds which retain the juvenile primaries and tail).

In the Vizagapatam ghats near Sankrametta La Personne reports that the Bay-backed Shrike was fairly common in December on the hill slopes leading to the Padwa valley, being found at elevations between 2,000 ft. and 3,500 ft. We can trace no other record in the Presidency above the Krishna River. South of that the bird appears to be common and generally distributed right down to the Cauvery River. From here it probably extends all the way to Cape Comorin where within the Travancore border Ferguson obtained two specimens in December 1901.

In the western side of the Presidency it does not occur except on the border of Mysore where William Davison found it about the northern base of the Nilgiris in the neighbourhood of Segore in February. We cannot trace the authority for the statement that it occurs in the Palnis and N. Travancore.

Nothing is recorded of the breeding season in the Presidency but elsewhere it lasts from April to September, the majority of eggs being found in the latter half of June and in July. This shrike is probably resident in the Presidency.

Lanius nasutus nigriceps (Franklin).

Collurio nigriceps Franklin, P.Z.S., 1830-31 (October 25, 1831), p. 117—Vindhyian Hills.

Specimens collected:—1341 ♂ 6-2-30 Anantagiri 3,000 ft.; 1450 ♂ 1-3-30, 1494 ♂ 7-3-30, 1503 ♀ 8-3-30, 1521 ♂ 11-3-30, 1564 ♂ 17-3-30, 1575 ♀ 20-3-30, 1578 ♀ 22-3-30, 1590 ♀ 24-3-30 Sankrametta 3000-3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
4 ♂	20-23	91-94.5	113-118	27.5-30 mm.
6 ♀	20.5-21	88-92.5	103-114	26-28.5 mm.

In the Anantagiri specimen in February, there was no sign of genital development, but in March the birds showed distinct development, especially in the males. At Sankrametta where these shrikes were common they were mating, chasing each other from tree to tree with harsh calls. Their behaviour was like that of all other shrikes. I have seen one of these shrikes give a very clever demonstration of stooping: It was flying about 30 feet up in the air when seeing a party of Zosterops up in a bush it closed its wing and shot down into the bush with lightning rapidity (La Personne). No other record for the Presidency.

This fine series of Black-headed Shrikes clears up an interesting point. The series is remarkably uniform and the birds have the upper parts from the edge of the black hood down to the centre of the back a clear unbroken grey. In Assam and Sikkim, from whence come most of the specimens in collections, the grey is browner in tint, as noted by Hume (S.F., xi, 90), and is confined to a narrow edging to the black hood while the mantle and upper back are bright rufous agreeing with the rump and upper tail coverts.

The range of the Black-headed Shrike is not known very satisfactorily in detail, but the following facts are clear. The most north-westerly record is of a single bird shot by A. E. Jones at Jagadri (Ambala District) on 4th. Feb. 1917 but this was doubtless a straggler. As a breeding bird, it is found along the lower Himalayas from the 'S.W. Termination of the Kumaon and Gharwal forests' (Thompson apud N. & E., vol. i, 315) to Bhutan and southwards through E. Bengal and Assam out of our limits. In much of this range it is very common. Between the Himalayas and the Ganges we have but few records —Gorakhpur (A. E. Osmaston), Mudhubani (Inglis), Purneah, Dinagepur, Colgong (Jerdon)— but hereabouts the bird is apparently scarce and possibly only a winter visitor, as it definitely is said to be at Calcutta.

South of the Ganges it is once more found in varying numbers from Etawah and Mogulserai (2 skins ex Brooks in British Museum), through S. Mirzapore (Thompson) to the Chota Nagpur-Orissa-Vizagapatam area where it is known to breed. Here its westerly limit is Nagpur (D'Abreu).

Correlating this distribution with the fact that the birds of the northern breeding range are rufous-backed and the birds of the southern breeding range are grey-backed and there is some intergrading between them, we have no hesitation in recognising two races in India.

There is no difficulty in deciding which of these should bear the well-known name of *nigriceps* as Franklin's original description—'dorso cinereo; scapularibus uropygio, abdominis lateribus, crissoque rufis—leaves no doubt that he was referring to the southern form and that the type locality selected should probably be the Vindhyian Hills rather than the Ganges between Calcutta and Benares.

Luckily there is a name available for the northern race—~~*Collurio*~~ *tricolor* Lanius Hodgson, (Ind. Review, vol. i, January 1837, p. 446—Nepal.) There is no difference between the breeding birds of the Nepal Valley and Assam, and Hodgson's original type of *tricolor* has been identified in the British Museum collection (Register no. 1845. 1. 9. 602.)[1]

There can be no doubt that the Black-headed Shrikes of our area belong to the same species as those of the Philippines *Lanius nasutus* Scopoli, Del. Fl. Fauna Insubr., ii, p. 85 (1786)—Philippines = Antigue, Panay which therefore gives its name to the group. Indeed the Peninsula form is so close to *nasutus* that it can only be distinguished on a series by the slightly richer rufous of the rump and scapulars. These parts are very pale in *nasutus*, the outer scapulars becoming almost white.

Lanius schach caniceps Blyth.

Specimens collected:—445 ♀ 18-6-29 Harur 1,000 ft.; 658 ♀ 6-8-29 Palkonda Hills 1,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♀	19.5-20.5	88-90	113	26-27.5 mm.

The main stronghold of this Grey-backed Shrike in the Presidency is in the hills of the western side where it is very common and resident on the higher parts of the Nilgiris, Nelliampathis and Palnis. In the first named

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[1] Since the above was written we have noticed that Tweeddale had already pointed this out over 50 years ago (Tr. Z.S. 1875, p. 170).

Davison says that it grows scarcer as one descends the slopes and in the Wynaad it is only sparingly distributed. In Coorg, according to Betts it is uncommon, being seen only occasionally and that in the drier parts. I have seen no skins from Coorg and it is not impossible that these may prove to be winter visitors of *L. s. erythronotus*. In Travancore this Shrike occurs not uncommonly both in the hills and plains.

On the east it is evidently much scarcer. Two unsexed specimens from Bellary (10-10-1877) are in the Hume Collection. Dewar says that it is not common at Madras and the two Survey specimens complete the records.

In Hume's N. & E. 2nd. ed., vol. i, pp. 323-325 there is a good deal of information about the breeding of this form in the Nilgiris and Palnis. The breeding season is from February to July, though May and early June appears to be the best time for eggs.

There appears to be no authority for the inclusion of *Lanius tephronotus* (Sensu auct.) in the Birds of Southern India, p. 59 (Inglis and Baker).

The identification of these two specimens has necessitated the examination of the whole question of the Rufous-backed and Grey-backed Shrikes of India and Central Asia. In the *New Fauna*, Mr. Stuart Baker considers that they should be divided into three forms namely *Lanius schach erythronotus* and *Lanius schach caniceps* and *Lanius tephronotus*. In vol. ii, p. 294 he gives as his reason for keeping *tephronotus* as a separate species that it has no white speculum and the tail always brown, not black. That these differences are not constant has already been pointed out by Ticehurst (J.B.N.H.S., xxxi, p. 495), who has also pointed out the extraordinary inconsistency of making Vigors' type locality of 'the Himalayas' into Lucknow for '*erythronotus* and Gyantse, Tibet for *tephronotus*. In the Ibis 1924, pp. 468-473 Ticehurst and Whistler had already shown that the Simla-Almora district might be taken as the area referred to by Vigors and had Mr. Stuart Baker not overlooked this he would have been spared his failure to appreciate the true systematic position of these Shrikes. This is really very simple. This large Shrike breeds from Tibet to Turkestan and Kashmir territories in the Trans-Himalaya (disregarding for the moment the rest of its range). In that wide area it falls into three recognisable breeding forms, the Rufous-backed Shrike in the west, the Grey-backed Shrike in the east, and a very distinct intermediate between them. The western bird is the *Collurio erythronotus* of Vigors. The *Collurio tephronotus* of Vigors is not, as has been hitherto assumed, the Grey-backed Shrike of the east, but the Grey-backed intermediate which as a winter visitor appears in the Simla-Almora area, and the Grey-backed breeding bird of Tibet must therefore be known by Hodgson's name of *Lanius nipalensis*. *Lanius caniceps* of Blyth is the Peninsula representative of the group. As the three first forms are migratory and there are large areas where we have no accurate information as to whether the birds breed at all or not the following must be regarded as only an approximate guide to the distribution of the forms recognised:—

Lanius schach erythronotus (Vigors).

Colluria erythronotus Vigors P.Z.S. 1830-1831 (April 1831), p. 42—Himalayas, restricted to Simla-Almora district.

Upper plumage clear pale grey. Rufous of rump extending to lower back and scapulars and sometimes even to lower mantle. White speculum generally present and large.

Breeding Turkestan, Gilgit, Kashmir, outer Western Himalayas, Baluchistan, Punjab. Winter visitor to Peninsula India.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
20 ♂	20-21.5	91.5-100	101-113	27-29.5 mm.
10 ♀	18-20.5	85-93.5	100-116	25-28.5 mm.

Lanius schach tephronotus (Vigors).

Collurio tephronotus Vigors, P.Z.S., 1830-1831 (April 1831), p. 43—Himalayas, restricted to Simla-Almora district.

Upper plumage darker, more leaden grey, intermediate in colour between *erythronotus* and *nipalensis* and easily distinguishable from either. Rufous of rump not extending beyond hindermost scapulars. White speculum usually present but on the average smaller than in *erythronotus*.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
10 ♂	19.5-21.5	90.5-98.5	104-120.5	26.5-28 mm.
6 ♀	20-22	92-100	106-112	27.5-29 mm.

Breeding Suru Valley and Lahul. Winter visitor to Outer Himalayas and Upper India.

Lanius schach nipalensis Hodgson.

Lanius nipalensis Hodgson., Ind. Rev., vol. i (1837), p. 445—Nepal. (Type in British Museum. Reg. No. 43, 1, 13, 762.)

Upper plumage dark bluish slate. Rufous on upper plumage not extending beyond rump. Rufous on lower plumage usually richer and more extensive than in other forms. White speculum absent or very small. The largest form.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
16 ♂	20.5-23.5	95.5-106.5	105-118	27.5-30 mm.
10 ♀	20.5-23.5	97-107.5	105.5-107.5	28-29 mm.

Breeding Tibet. Winter visitor to Nepal Valley, outer Eastern Himalayas, Assam and Burma.

Lanius schach caniceps Blyth.

Lanius caniceps Blyth, J.A.S.B., xv (1846), p. 302—India = Madras (see J.B.N.H.S., xxxiv, p. 396).

Upper plumage clear pale grey as in *erythronotus*. Rufous of rump only extending to hindermost scapulars as in *tephronotus*. White speculum usually present but small. Usually smaller with a weaker bill than in other forms.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
9 ♂	20-22	92-98	112-129.5	26.5-28.5 mm.
5 ♀	19.5-21	86.5-93	103.5-114	26-27.5 mm.

Central and southern Indian Peninsula; Ceylon. Apparently resident.

This form is not well differentiated from *L. s. erythronotus* and indeed grades into it. There is little evidence as to which form, if any, breeds over Northern India, other than the Punjab.

It is no doubt true, as generally stated, that in *nipalensis* (*tephronotus* auct.) the central tail feathers are usually brown, and in *erythronotus* black. But these distinctions are not reliable as in *nipalensis* the terminal half of the feathers is often black, whereas in first year individuals of *erythronotus* the brown central juvenile tail feathers may be retained instead of being shed at the post-juvenile moult. Similarly in these immature birds the retention of the brown primaries and primary coverts of the juvenile plumage explains the absence of the white speculum.

Lanius cristatus cristatus Linnaeus.

Lanius cristatus Linn., Syst. Nat., ed. x (1758), p. 93—Bengal.

Specimens collected:—12 ♀ 10-4-29, 32 ♀ 12-4-29, 103 ♂ 21-4-29, 139 ♂ 27-4-29 Kurumbapatti; 897 ♀ 10-10-29 Seschachalam Hills 2,000 ft.; 1030 ♀ 25-11-29 Nallamallai range 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	18.5-19	89	81-83	23.5-26.5 mm.
4 ♀	18-19	89	81-81.5	25-26.5 mm.

In 3 of the 4 spring birds a complete moult is in progress.

The above specimens constitute the whole of the records for the eastern side of the Presidency. On the west the Brown Shrike is far better known. In Coorg it is one of the commonest of the cold weather visitors, arriving in September [11 September—earliest date (Betts)] and staying until the end of March. It is not recorded from the Wynaad or the Malabar coast but in the Nilgiris it is also very common as a winter visitor. William Davison gives its dates as from the end of November to early in March, but Betts records it (J.B.N.H.S., xxxiv, 569) as seen as early as 7 October. In Travancore it is a winter visitor to the hills from 2,000 ft. upwards and Ferguson shot it as high as 6,000 ft. on the High Range. He also obtained a specimen in the low country of North Travancore in December 1902.

As Brown remarks that this shrike reaches Ceylon regularly in August every year (J.B.N.H.S., xxxii, 376), it is evident that it must occur in the Presidency earlier than the above records would lead one to suppose.

Hemipus picatus picatus (Sykes).

Muscicapa picata Sykes, P.Z.S., 1832, p. 85—Deccan.

Specimens collected:—297 ♀ 31-5-29, 351 ♂ 354 ♂ imm. 412 ♂ 7-6-29, 410 ♂ juv. 413 juv. 14-6-29 Chitteri range 2,000 ft.; 1361 ♂ imm. 1367 ♀ 10-2-30, 1408 ♂ 19-2-30, 1748 ♂ 30-4-30 Anantagiri 3,000 ft.; 1464-5 ♂♂ 3-3-30, 1537 ♀ 1540 ♂ 14-3-30, 1682 ♀ 13-4-30 Sankrametta 3,500 ft.; 1748A ♂ imm. 30-4-30 Jeypore Agency 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
10 ♂	14-16	60-65.5	58-62.5	11-13 mm.
4 ♀	15.5-16	60.5-64.5	58.5-65	12-13 mm.

The above specimens supply the whole of the records for the east of the Presidency and provide a marked extension of the known range. La Personne reports that the Black-backed Pied-Shrike was very common throughout the Ghats of the Vizagapatam district. In April they appeared to be breeding in thick forest at Sankrametta.

On the western side the bird is far better known. It is common in Coorg, the Wynaad, and the Nilgiris at all elevations. Kinloch says that it is common in the Nelliampathis. Fairbank met with a few in the Palnis. In Travancore it occurs throughout the range at all elevations from the foot of the hills to the summits.

The breeding season in the Nilgiris appears to be in March. The male in first winter plumage is not distinguishable from the female.

Tephrodornis gularis sylvicola Jerdon.

Tephrodornis sylvicola Jerdon, Madras Journ. Lit. Sci., x (1839 after October) p. 236—'Inhabits the dense and lofty forests of the Western Coasts and Ghats. I have found it on the Coonoor Pass as high as 5,000 ft.

Not obtained by the Survey. The *New Fauna* states that the Malabar Wood-shrike occurs almost up to Bombay city but I have failed to trace any record of it higher than the jungles west of Belgaum (Laird). In the Presidency it is confined to the western side. Jerdon's term—the forests of the Malabar Coast—is somewhat indefinite but Mr. Betts informs me that it is common about Mercara in Northern Coorg and that the Wood-shrike which he recorded as uncommon in South Coorg (J.B.N.H.S., xxxiii, 545) is probably this species and not *pondicerianus*. In the Wynaad, according to William Davison, it is fairly numerous, and he shot it as high as Neddivattum about 5,500 ft. though it is rare at this height and certainly does not ascend to the tableland of the Nilgiris.

Kinloch considered it very common in the Nelliampathis. In the Palnis Fairbank found it in the stunted trees of the western side about 4,500 ft. In Travancore it is said to be common from the foot of the hills to about 3,000 ft. in heavy forest.

The breeding season in this bird's whole range is said to be from March to June but there is no published record for the Presidency.

I should remark that some of the above records appear under the name *pelvica* but I have no reason to think that more than one large Wood-shrike is found along the west of our area.

Tephrodornis gularis subsp. ?

Lanius gularis Raffles, Trans. Linn. Soc., xiii (1821), p. 304—S. W. Sumatra.
Specimens collected:—1368 ♂ ad. 10-2-30 Anantagiri 3,000 ft.; 1600 ♂ imm. 24-3-30 Sankrametta 3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	25.5-26.5	115-118.5	84-86	20.5-21 mm.

These two specimens furnish the only records of the Nepal Wood-shrike in the Presidency and I am unfortunately unable to say with certainty to which subspecies they belong. The upper parts of the adult male are definitely darker and greyer throughout than in birds from Nepal and Darjeeling and I cannot separate them in any way from *T. g. annectens* (Kloss). The young (1st. winter) male however, which is in female plumage, except for the retention of certain juvenile feathers in the wings and tail, agrees well with *T. g. pelvicus* (Hodgs.). The status and identity of the bird in this area must await further investigation.

Tephrodornis pondicerianus pondicerianus (Gmelin).

Muscicapa pondiceriana Gmelin, Syst. Nat., i (1789), p. 930—Pondicherry.
Specimens collected:—89 ♀ 19-4-29, 178-9 3-5-29 Kurumbapatti; 512 ♀ 5-7-29 Kalai, Trichinopoly; 559 ♂ juv., 561 ♂, 563 ♂ 19-7-29, 590 ♂ juv. 23-7-29 Gingee; 598-9 ♂ juv., 0 ?, 600-1 ♀ juv., ♂ Tindivanum; 657 ♂ 6-8-29, 670 ♂ 9-8-29 Palkonda Hills 1,000 ft.; 839-40 ♂♀ 20-9-29 Kodur; 884 ♂ 888-9 ♂♂ 7-10-29, 913 ♂ 13-10-29, 919-20 ♂♀ 14-10-29 Seschachalam Hills 2,000 ft.; 958 0 ? 1-11-29, 1038 ♀ 25-11-29 Nallamallai Range 2,000 ft.; 1344 ♂ 6-2-30 Anantagiri 3,000 ft.; 1492 ♀ 7-3-30 Sankrametta 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
16 ♂	19.5-22.5	82-91	59-67	17.5-19.5 mm.
8 ♀	19-22	85-89	60.5-65	16-19.5 mm.

There appears to be no necessity to cite all the records of the Common Wood-shrike in the Presidency as it is evidently very common and generally distributed except in the wetter and higher country of the western side. There it does not occur in the Nilgiris, Nelliampathis, Palnis or Travancore ranges, though it is still common in the plains about their base and occurs in smaller numbers in (Coorg ? and) the Wynaad.[1]

Although we include all the Presidency birds under the typical race it is to be remarked that the two Survey specimens (1344-1492) from the Vizagapatam Ghats are somewhat darker above and below than the rest of the series, agreeing thereby with birds in the British Museum from Calcutta, Barrackpore, Dacca and Burma generally. We doubt, however, whether it is worth while separating them racially. At the other extremity of our area the Travancore series in the British Museum are somewhat intermediate with *T. p. affinis* of Ceylon (as noted by Hume, S.F., i, p. 435) and it is interesting to note (as he explained in S.F., iv, 458) how this is due to the agreement between the climate of Travancore and parts of Ceylon, whereas on Rameswaram Island, literally closer to Ceylon but in physical features nearer to Central India, the birds are quite typical.

Nothing seems to have been recorded about the breeding season in the Presidency but the organs of the Survey specimens suggest that it is in April and May.

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[1] Mr. Betts informs me that his Coorg record (J.B.N.H.S., xxxiii, p. 545) is probably due to a mistake in identity.

Pericrocotus speciosus semiruber subsp. nov.

Specimens collected:—1327 ♂ 5-2-30, 1442 ♀ 26-2-30, 1776 ♀ 5-5-30 Anantagiri 3,000 ft.; 1683 ♂ 15-4-30 Sankrametta 3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	20-21	100.5-102	96-99	18-19 mm.
2 ♀	19-20	97-102	92.5	18-18.5 mm.

La Personne reports that this Scarlet Minivet was fairly common and evidently about to breed in the hill tracts of Vizagapatam District. There was a good deal of sexual display during the latter end of April. Jerdon mentions (Madr. Journ. Lit. & Sci., x (1839), p. 243) that he shot one of a pair in the spring in Goomsoor, but there is otherwise no record for the Presidency. This form however extends also into Chota-Nagpur and the Eastern Central Provinces.

The identification of this series of Minivets has given us a good deal of trouble, but we have been greatly helped by Ticehurst's note on the Assam-Burma races of this species (J.B.N.H.S., xxxiv, 906). The important points in the racial separation of the Scarlet Minivets are size, the number of outer primaries in both sexes which lack a coloured spot on the outer web, and the amount of red and black on the central pair of tail feathers in the adult male. Fortunately we have been able to supplement the small Survey Series with several other specimens from cognate localities (Sambalpur, Bilaspur, Ranchi, Maunbhum, Orissa and Dumagudiam). The total series agree in having the first two primaries unspotted in the male, the first three (usually) in the female. The red on the central pair of tail feathers is very extensive, usually occupying the whole of the terminal two-thirds of the outer webs. The series measure:—

	Wing.	Tail.
7 ♂	100-106.5	94-102 mm.
4 ♀	96-102	92.5-101 mm.

These birds are certainly not *elegans* (Assam and Burma) in which the first three primaries of both sexes are unspotted, the whole of the outer web of the central tail feathers is red and the size is small, wing ♂ 95-102, tail about 90 mm.

From our birds *fraterculus* (Hainan) differs in size (♂ wing 94-98 mm.) and in having the central tail-feathers wholly black.

Flammifer (S. Tenasserim—Malay) has the outer webs of the central tail feathers red, but it is much smaller (wing ♂ 89-95.5 mm.) and the first three primaries in the male and four in the female are unspotted.

Andamanensis (Andamans) has the first three primaries unspotted in the male and the central pair of tail feathers are wholly black. Wing ♂ 92.5-95 mm.

In *speciosus* (Himalayas) the first two primaries in the male and the first three primaries in the female are unspotted. In the western Himalayas (Gharwal—Kumaon) the red on the central tail feathers is usually entirely absent.[1] When it occurs it is merely a narrow line along the edge of the outer web about one inch in length. In the Eastern Himalayas (Sikkim-Duars) the red is more often found and is greater in extent, though it seldom reaches to the shaft. The western birds on the whole are slightly larger than the eastern, but the sum of these characters is not sufficient to allow of the separation into the usual east and western ranges. The explanation no doubt is that the Scarlet Minivet is a comparatively recent colonist of the Himalayas. It is not yet common beyond the Jumna Valley and the most westerly authentic record is Kulu.

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[1] Gould's figure of *Muscipata princeps* (Vigors) shows a male with no red on the central tail feathers and only the first two primaries unspotted, a further argument for the placing of the Vigors' collection in the Simla-Almora area (Ibis, 1924, pp. 468-673).

Measurements:—

	Wing.	Tail.
17 ♂	100-110.5	96-113 mm.
8 ♀	97.5-108	95-110 mm.

Our series therefore differ from *speciosus* in their smaller size and the greater amount of red on the tail, in other words an advance along the lines in which the East Himalayan bird is tending to vary from the West Himalayan.

The degree of difference is however greater between the Eastern Ghats birds and the Sikkim birds, than between Sikkim and Kumaon. The breeding ranges are also separated by the Gangetic Plain. We therefore think that it will be useful to recognise an Upper Eastern Ghats race and propose for it the name:—

Pericrocotus speciosus semiruber Subsp. nov.

Type ♂ 15 April 1930, Sankrametta, Vizagapatam 3,500 ft. Collected by V. S. La Personne, Coll. No. V 1683, Brit. Mus. Reg. No. 1932. 6. 1. 2

We do not consider that the Scarlet Minivet is racially connected with the Orange Minivet (*Pericrocotus flammeus*). A marked characteristic of the Minivets as a whole is that racial variation has less effect on their bright colours than other details of their make-up and in the *speciosus* group the stability of the scarlet tint is very remarkable, and goes side by side with a close intergrading of the racial characteristic. There is moreover no trace of intergradation between *flammeus* and *speciosus*.

Pericrocotus flammeus (Forster).

Muscicapa flammea Forster in Pennant's Indian Zoology, 1781, p. 25—Ceylon.[1]

Specimens collected:—210 ♂ 12-5-29, 220-221 ♀, ♂ imm., ♂ ad. 14-5-29 Shevaroy Hills 3,500-4,000 ft.; 422 ♀ 15-6-29 Chitteri range 3,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	17.5-18	94-97	95-101	15.5-17.5 mm.
2 ♀	18-18.5	92-93	90-93	16.5-17 mm.

The Orange Minivet is far better known in the west than in the east of the Presidency. For the east the above specimens constitute the only record, substantiating La Personne's remark that they were very common on the Shevaroys and the Chitteri plateaux about 3,500 to 4,500 ft. A few were also apparently seen in the plains below.

In the west they are common in the Palnis, from the bottom to the top, the whole of the Travancore ranges up to 4,000 ft., the Nelliampathis, the Nilgiris up to about 5,000 ft. (and occasionally higher), and in the Wynaad and Coorg. They are also common, according to Jerdon, through all the forests of Malabar. This Minivet occurs in Ceylon but the few specimens available from there suggest that Cinghalese birds are smaller than those from the main land.

Very little seems to be known about the breeding of this race. In Coorg the flocks are said not to break up until May or June and this agrees with Miss Cockburn's statement that in the Nilgiris the breeding season is in June and July. Darling, however, found a nest with two eggs as late as September 5 at Neddivattum 6,000 ft. and Betts also remarks that he found a nest in the Nilgiris in September.

Pericrocotus brevirostris Subsp. ?

Muscipata brevirostris Vigors, P.Z.S., 1830-31 (6 April, 1931), p. 43—Himalayas, Simla-Almora area.

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[1] This was described by Forster from Governor Loten's drawings the originals of which are in the British Museum. On this particular drawing Loten quaintly remarks 'Name of the Bird and Plant forgot; if I ever find again my annotations I may possibly recover it'.

Jerdon clearly tells us (Madr. J. Sci. Lit. vol. x, p. 244 and B. of I. vol. i, p. 421) that he was fortunate enough to procure this species in Gumsoor. The specimen no longer apparently exists but there seems no reason to reject the record, especially as a specimen collected by Beavan in January 1865 in Mannbhum is in the British Museum.

Pericrocotus roseus roseus (Vieillot).

Muscicapa rosea Vieillot, Nouv. Dict. d'Hist. Nat., xxi, 1818, p. 486—Bengal.

Specimens collected:—1599 ♂ 24-3-30, 1610 ♂ 27-3-30, 1634 ♂ imm. 31-3-30, 1658-9 ♂ ♀ 4-4-30 Sankrametta 3,000-3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
4 ♂	16-17	88.5-92.5	91.5-93.5	15-16 mm.
1 ♀	17	90	91	16 mm.

The Rosy Minivet appears to be rather a scarce and local species in the Presidency. Jerdon states that he procured it at Gumsoor, and Ball was under the impression (S.F., v, p. 415) that he had seen one at Jaipur (Jeypore). La Personne found them uncommon and restricted to rather thick forest at Sankrametta and in April the breeding season was commencing, to judge by the organs of the above specimens.

Elsewhere in the Presidency the status of the Rosy Minivet is not very clear. Jerdon says (B. of India, vol. i, p. 423) 'I obtained it from various parts of Malabar. Lord Arthur Hay informed me that he had seen it most abundant on the hills dividing Tinnevelly from Travancore; and collections from this latter country always include it.' Yet in spite of this very clear statement that the bird is common in this area, we can only find confirmation in Ferguson's pair shot at 2,500 ft. on Ponmudi, Travancore, in January 1894 (J.B.N.H.S., xii, p. 202; xv., p. 460). None of the numerous other observers in the west of the Presidency have apparently met with it.

In spite of the wide and curiously local distribution of this Minivet in India no subspecies are recognisable within India.

Pericrocotus peregrinus peregrinus (Linn).

Specimens collected:—113-114 ♂ ♀ 23-4-29 Kurumbapatti; 387 ♀ 12-6-29 Chitteri range 3,000 ft.; 552 ♂ 18-7-29, 566 ♀ 20-7-29, 580, 581, 583 ♂ ♀ ♂ 22-7-29 Gingee; 678-679 ♂ ♂ 12-8-29, 717 ♂ 20-8-29 Palkonda Hills 1,000 ft.; 787 ♀ 2-9-29 Kodur; 849 ♀ 29-9-29, 890, 893, 894 8-10-29 Seschachalam Hills 2,000 ft.; 1067 ♂ 8-12-29, 1141 ♀ 19-12-29, 1173 [♂] 25-12-29 Cumbum Valley; 1331, 1335 ♂ ♂ 6-2-30, 1357-1358 ♀ ♂ 9-2-30 Anantagiri 3,000 ft.; 1670 ♂ 6-4-30 Sankrametta 3,500 ft.; 1738 ♂ 28-4-30.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
16 ♂	12-13.5	63.5-72.5	65-77	14.5-16.5 mm.
9 ♀	12-13.5	64.5-69.5	65-78	14.5-16.5 mm.

The Little Minivet is evidently common and generally distributed all down the eastern side of the Presidency alike in the plains and in the hills up to at least 3,500 ft., and there is therefore no need to enumerate the existing records. It should, however, be remarked that the specimens from the Vizagapatam Hills are more richly coloured than the rest of the series and show that the intergrading with *P. c. vividus* begins in this area.

The breeding season in the Presidency is not very accurately recorded. The organs of the Vizagapatam series suggested that they would breed about May. At Madras Bates records a clutch of 3 eggs on 29th July (J.B.N.H.S. xxxi, 284) and gives some interesting notes on the behaviour of the birds. At Kurumbapatti La Personne met fledged young on June 10th.

It is not generally realised that the first winter male of this species at the postjuvenal moult assumes a plumage similar to that of the adult female. Almost immediately after the moult, however, odd feathers of the chin, throat and upper breast are accidentally lost and replaced by the corresponding adult feathers, the process being accelerated by a partial spring moult of those parts. First summer males are therefore distinguishable by a piebald black and grey throat with a slight nimbus of flame colour and they breed in this state, moulting to adult plumage in the postnuptial moult.

Any study of the races of the Little Minivet must be prefaced by the consideration of its correct specific name. For this there are only two possible candidates *Motacilla cinnamomea* (p. 335) and *Parus peregrinus* (p. 342) both Linnean names of the xii edition, with merely page priority between them. If the former name really applies to this species it should take precedence but the diagnosis is absolutely wrong and the description so bad that it has usually been set aside. The whole question has been considered at full length by Hume (S.F. v, pp. 179-182) who decided that the name and description should be set aside. Hume was prepared to accept, with some reservation, Ceylon as the correct type locality for this name, but if Chasen and Kloss (J.B.N.H.S. Siam, vol. v, pt. 3 (1924), p. 251) are right in their suggestion that Governor Loten's specimen, whatever it was, came more probably from Java, the identification of this name becomes still more doubtful. Recently Streseman (Ornith. Monatsb. 1923, pp. 40-41) has attempted to revive the name *cinnamomea* for this species, but in the absence of new or decisive evidence we are of opinion that the practice of half a century, and the determination by one of the most competent authorities possible should not be upset. At any rate we propose ourselves to reject *cinnamomea* as indeterminable and accept *peregrinus* as the correct name for this species, as heretofore.

We are afraid that the student in India will be somewhat puzzled by Mr. Stuart Baker's treatment of this species. In the Bull. B.O.C., xl, (1920) p. 115, he fixed the type locality of *peregrinus* as Ambala, an unfortunate locality as the birds there are intermediate and in Linne's day specimens could hardly have come from anywhere nearer than Bengal (see Ticehurst, Ibis, 1922, p. 613). In vol. ii, p. 329 of the *New Fauna* (May 1924) he kept to his original treatment in spite of what Dr. Streseman had written in 1923 but later accepted the latter's opinion and revised his own in Bull. B.O.C., xlix, pp. 63-64 (1929). Here for no reason at all (and forgetting that the description obviously applies to a northern bird) he assumes that the correct type locality for *peregrinus* must be Ceylon, gives the wrong reference for his previous restriction of the type locality to Ambala, and proposes a new name *iredalei* for the continental race, still with the type locality of Ambala. Finally in vol. vii, p. 156 he gives *malabaricus* as a synonym of the Ceylon race and in viii, p. 637 says that the differences between the Malabar and Ceylon races are quite easily determined and the subspecies must be maintained, though in the main text, he has not accepted the difference. It is all very confusing.

Forgetting all this we may go back to the type locality for *peregrinus*. Here Mr. Stuart Baker's restriction to Ambala must undoubtedly stand, following as it does on Hume's original and correct decision that the name clearly refers to northern birds as opposed to the richly coloured birds of the south. This species is unusually susceptible to climatic and geographical influences. In Sindh it is a pale desert bird. In the Malabar rain area it is as richly coloured as any tropical species. In Ceylon an island race approximates to another richly coloured bird of Burma and the Andamans. Whilst in the greater part of India an intermediate connects these variant forms, remaining unchanged through the immense area of the Peninsula from the Cauvery to the Sutlej and on its edges grading into the other races. To this intermediate the name of *peregrinus* must apply. But it must be appreciated that as three of the races into which it grades share a common character of richness of colouration the birds of those intergrading edges will be found to approximate somewhat closely amongst themselves. The student may be reminded that this is one of those species of which the racial characteristics are only recognizable in series.

In describing these races it will be found convenient to start with the most richly coloured form.

Pericrocotus peregrinus malabaricus (Gmelin).

Parus malabaricus Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 1012—Malabar.

♂ Upper plumage slate grey and rich flame colour, throat black. Red on the lower plumage very rich and extensive, reaching to the lower flanks and abdomen. Remainder of the lower plumage, including under wing and under tail coverts deep yellow, sometimes almost orange, without any trace of white. Tail tips and wing spot reddish orange.

♀ Whole underparts yellow, deeper on abdomen.

West coast of India from N. Kanara to Travancore.

Pericrocotus peregrinus ceylonensis Subsp. nov.

Type. ♂ 7th. Nov. 1895 Cocawatte, Ceylon. Collected by A. L. Butler. Brit. Mus. Reg. No. 1916:9. 20. 621.

♂ Throat black. Differs from the last as follows:—The grey of the upper parts is not so dark, nor the flame colour so rich. The red on the lower plumage is not so extensive, covering the flanks but not the upper abdomen; remainder of lower plumage pale yellow, albescent in the centre.

♀ Lower parts greyish white, washed with yellow on flanks, under wing coverts and under tail coverts.

Ceylon.

Pericrocotus peregrinus vividus Stuart Baker.

Pericrocotus peregrinus vividus Stuart Baker, Bull. B.O.C., vol. xl (30th. April 1920), p. 114—Nedong Attaran River, Burma (Type in British Museum). Differs from the last merely in the ♂ having a grey throat. The Duars, Assam, Burma and probably eastwards. A series from the Andamans evidently belong to this form (in spite of Van Schauburg, Treubia, vol. xi, pt. 3 (Feb. 1930), p. 311).

Pericrocotus peregrinus peregrinus (Linn).

Parus peregrinus Linn. Syst. Nat., ed. xii, vol. i (1766), p. 342—No locality. restricted to Ambala (Bull. B.O.C. xl (1920) p.115).

♂ Throat black or sooty grey. Compared with Ceylonensis the grey of upper parts is paler and fire colour of rump less intense; the red on lower plumage is less extensive, being largely confined to the upper breast and upper flanks and even these not so solid and unbroken. Remainder of lower plumage white, merely washed in places with yellow. Tail tips paler.

♀ as in *Ceylonensis*.

India south of the Himalayas, exclusive of the range of *malabaricus*, *vividus* and *pallidus*.

Pericrocotus peregrinus pallidus (Stuart Baker).

Pericrocotus peregrinus pallidus Stuart Baker. Bull. B.O.C. vol. xl (30th April 1920) p. 115—Larkana, Sindh.

♂ Throat grey. Compared with the typical race the grey of the upper parts averages still paler; the flame colour of rump and upper tail coverts less intense and yellower. The lower plumage white, the yellow and red confined to a narrow band below the throat and a wash on the upper flanks. Wing spot largely white and tail tips very pale.

♀ The upper parts, wing spot and tail tips are paler even than in *peregrinus*.

S.W. Punjab and Sind.

Pericrocotus peregrinus malabaricus (Gmelin).

This very richly coloured race of the Little Minivet occurs down the western side of the Presidency in the heavy rain area. Its distribution is not very accurately known but we have examined specimens from Malabar and Travancore and presumably the records from the Wynaad (W. Davison), the Nelliampathis (Kinloch) and the Palnis (Fairbank and Terry) refer to the same form. Betts' record (J.B.N.H.S., xxxiii, 545) of *P. erythropygius* as common in Coorg must surely also refer to this species. It does not seem to be very common anywhere but more information about it is required.

Pericrocotus erythropygius (Jerdon).

Muscicapa erythropygia Jerdon, Madras Jour. Lit. Sci., vol. xi (January 1840; after May 1840) p. 17—Jungle on the top of the Ghats, near Ajunteh.

As noted above Betts' record that this species is common in Coorg must surely be a mistake. In the *New Fauna* vol. ii., p. 333 Mr. Stewart is recorded as having taken eggs in Travancore. There is no other record for our area, and this extension of range seems to require further confirmation.

Lalage melaschista (Hodgson).

Volvocivora melaschistos Hodgson., Ind. Review, vol. i (Nov. 1836) p. 328—Nepal.

Jerdon informs us (B. of I. vol. i, p. 416) that the Dark-grey Cuckoo-shrike 'has been procured in Goomsoor' and this is the only record for the Presidency. There is nothing improbable about this record as the bird is fairly well-known as a winter visitor to the area known as Chota Nagpur, but Jerdon carefully draws a distinction between this and his own experience and I have failed to trace the original record on which the statement is based.]

Lalage sykesi Strickland.

Lalage Sykesi Strickland, Annals Mag. Nat. Hist., (1) xiii (1844), p. 36.—Calcutta.

Specimens collected:—196 ♀ 6-5-29 Kurumbapatti; 574 ♂ 21-7-29 Gingee; 736 ♂ 23-8-29 Palkonda Hills 1,000 ft.; 854 ♂ 30-9-29, 904 ♀ 11-10-29, 929 ♀ 18-10-29 Seschachalam Hills 2,000 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
3 ♂	18.5-19	98-101	72-76.5	20-20.5 mm.
3 ♀	17.5-18	100-100.5	75-80	20.5-22.5 mm.

The Black-headed Cuckoo-shrike seems to be fairly generally distributed in small numbers throughout the Presidency. Ball records it from Gumsoor probably on Jerdon's authority. La Personne says that it was general and common in January in the Godaveri delta though no specimen was actually procured. In addition to the specimens enumerated above, from further South we have Mr. W. A. Hasted's statement that it occurs at Chittoor, Mr. Dewar's record that it is common at Madras and Jerdon's statement that it is a fairly common visitor about October-November to the Carnatic, meaning more particularly the neighbourhood of Trichinopoly.

As authority for the west we have one of Wardlaw-Ramsay's specimens in the British Museum from Cannanore (7 Sept.). In Coorg Betts states that it is common in winter, disappearing about the end of March. In the Wynaad and the Nilgiris William Davison states that it is not abundant. He procured it as high as Ootacamund.

For the Palnis we find only a single record. Fairbank procured a male at Periur. In Travancore Ferguson says that he has found it most commonly in the low country—a male collected by him at Quilon on 25-2-80 is in the British Museum,—but that he had taken it in the hills at about 2,500 ft. Col. Sparrow met it in the Cardamum Hills in March.

The distribution of this Cuckoo-shrike is not complete as given in the *New Fauna* (vol. ii, p. 340). In the north-west it certainly occurs up to a line through Mt. Abu, Sambhur and Bareilly from all of which localities there are specimens in the British Museum. We cannot find any racial variation in its wide range, which is due no doubt to the fact that it is much more of a migrant than is generally realized.

Unfortunately the records do not allow of our working out the migrations in detail, but in the United Provinces (Gill, J.B.N.H.S., xxix, p. 338), Baroda (Littledale, J.B.N.H.S., i, p. 32), Sehore (Whitehead J.B.N.H.S., xxi, 161) and Calcutta (Munn, Ibis 1894, p. 46) the bird is clearly a rains visitor from about June to September, and a marked passage, in June and again in September-October, to those breeding grounds has been independently recorded at Dhulia (James Davison, S.F., x, 301) and Belgaum (Butler, S.F., ix, 393). In North

Kanara (James Davison, J.B.N.H.S., xi, 665) and Coorg (Betts) it is only known to winter. La Personne noticed an increase in their numbers in the first week of May at Kurumbapatti but much more information is needed before we can understand the local movements, as the bird evidently breeds both in Mysore and Ceylon. In Ceylon it is said to breed in March and April.

Graucalus javensis macei (Lesson).

Graucalus macei Lesson, Traite (end of 1830 or beginning of 1831), p. 349—Bengal, now restricted to Calcutta.

Specimens collected:—249 ♀ 19-5-29 Shevaroy Hills 4,500 ft.; 337 ♀ 5-6-29 Chitteri range 2,000 ft.; 976 ♂ 6-11-29, 1015 ♂ 19-11-29, 1112 ♀ 14-12-29 Nallamallai range 2,000 ft.; 1203 ♀ 8-1-30 Godaveri Delta.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
2 ♂	27-29	158-167	122-124.5	24.5-25 mm.
4 ♀	26-28.5	158.5-165	117.5-129	23.5-26 mm.

Very little is really known about the Large Cuckoo-shrike in the Eastern side of the Presidency. Ball records it from Jeypore (S.F., vii, p. 210). La Personne met with it in the Godavery Delta and also in the Cumbum Valley and the Nallamallai range. Roscoe Allen says that it was breeding at Horsleykonda in May (J.B.N.H.S., xviii., 907).

About Madras itself Dewar remarks that it can scarcely be said to be common though Capt. Bates informs me that he saw it not infrequently in the cold season at St. Thomas' Mount but not after February. Further South La Personne procured it in the Chitteri range, and the Shevaroys and reported it to be common in both ranges as well as about Kurumbapatti in the plains of Salem district.

In Travancore it is not uncommon in the low country in thin jungle, ascending the hills up to about 1,500 ft. (Ferguson). Hume (S.F. vii, 35) considered that Travancore birds should be attributed to the small Ceylon race *layardi*, but we agree with the *New Fauna* that they are better kept with the typical race.

In the Palnis it appears to be a rare bird. Fairbank met one at Periur and Terry met it in the Pittur valley. A specimen procured in July at Malappuram is in Colonel Sparrow's collection. William Davison considered it rarer than *Lalage sykesi* on the slopes of the Niligris and in the Wynaad, but Betts records it as a common resident in Coorg. A specimen from Calicut is in the Hume collection and Jerdon mentions a nest at Tellicherry (B. of I., i, p. 417).

The plumages of the Cuckoo-shrikes are not very generally understood. They are important, as in this species the sequence of plumages is reflected in the racial characteristics and therefore instructive to the student of evolution.

In this the typical race the adult male has dark ear-coverts and black lores; the throat and breast are uniform grey while the abdomen and flanks are barred; the centre of the abdomen, the vent and under tail coverts are white.

In the adult female the lores are the same dark colour as the ear-coverts; the throat, breast, abdomen and flanks are barred, the barring extending usually further down than in the male and sometimes almost absorbing the white area.

The first year male and female after the postjuvenal moult are alike and similar to the adult female. They may however be distinguished from her by two points:—(1) the primary coverts are more or less uniform in colour with a white edge running round the whole of the tip. In the adults of both sexes these coverts are blackish with marked grey edges and a white edge only on the outer side of the tip: (2) the outer tail feather on each side is narrow and pointed, being of course retained from the juvenile plumage.

In the large Himalayan race *G. j. nipalensis* the evolution from the barred to the uniform plumage has advanced a stage further. Here the adult female and the first year male and female (which may be distinguished from her by the same two points as in the typical form) have the throat and breast grey, followed by a certain amount of barring. In other words they practically correspond with the adult male of the typical form, though the amount of barring is somewhat less. The adult male has eliminated all barring and is uniform grey from the throat to the white ventral patch.

There is a gradual increase in size from *G. j. layardi* of Ceylon (♂ wing 145.5-151 mm.) through the typical race to *G. j. nipalensis* (♂ wing 174.5-186 mm.). We find no authority for the statements in the *New Fauna* that in *G. j. nipalensis* the adult female has the throat and foreneck barred or that *G. j. macei* wanders into the N.-W. Himalayas up to 4,000 ft. We are not clear as to what the author understands by Eastern Bengal where he states *G. j. nipalensis* occurs. If this expression refers to the Darjeeling area we agree. About Calcutta however the form is *G. j. macei*. From between those two areas there appear to be no skins in England.

Artamus fuscus Vieillot.

Artamus fuscus Vieillot, Nouv. Dict. d'Hst. Nat., nouv. ed., vol. xvii (1817), p. 297—Bengal.

Specimens collected:—174 ♀ 2-5-29 Kurumbapatti; 272 ♂ 23-5-29 Shevaroy Hills 4,000 ft.; 587 ♀ 23-7-29 Gingee.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
1 ♂	21	129	...	17 mm.
2 ♀	21.5-22	130-132	50-53.5	17 mm.

The Ashy Swallow-shrike is well distributed and locally common in the Presidency as is evident from the following records.

Jerdon includes the Northern Circars in the list of areas where he found this species most abundant. It was not reported by the Survey in this area but possibly the bird is here a migrant as in Sikkim it is a summer visitor only (see Gammie apud N. & E., 2nd. ed., i, p. 351 and Stevens, J.B.N.H.S., xxx, p. 56). There is no further record until Madras is reached. Here according to Dewar and Bates the bird is common, the Buckingham Canal being cited by the former as a particularly favourite locality. La Personne procured it at Gingee and says that it was very common in May at 3,000 ft. on the Shevaroys, frequenting open country. He also saw it on the Chitteri range. The specimen procured at Kurumbapatti was the only one seen, though it was apparently feeding a fledged chick. As Jerdon records it at Palamcottah and the Wulliar jungle and Hume obtained a male (now in the British Museum) on 17-3-75 on Rameswaram Island and Ferguson says that it is common throughout the low country of Travancore, especially in the palmyra palm country of the extreme south, it is evidently general in the south of the Presidency.

Ferguson says also that in the hill country of Travancore it is only found in the dry weather. In the Palnis Fairbank obtained it in thin jungle at 4,500 ft. and Captain Bates informs me that he saw a pair at Kodaikanal 7,000 ft. on 5 May 1929.

A male obtained in the Palghat District on 29-10-68 (Theobald) is in the British Museum. In the Nilgiris William Davison says that it is not uncommon at 5,500 ft. but does not ascend higher. He also met it in many places in the Wynaad and Betts records that it is locally common in Coorg. Finally a male collected by Wardlaw-Ramsay at Cannanore on 9-10-82 is in the British Museum.

There appears to be little information about the breeding season in the Presidency. Miss Cockburn took c/3 eggs on 17 May in the Nilgiris and La Personne saw the fledged chick at Kurumbapatti on 2 May.

This is an interesting species of which we require a good deal more information. The chick in spirit is badly required for examination and we require to know more about the powder-down tracts which are said to exist in the adult. The ecological connection with the palmyra palm and the extent to which this bird feeds on butterflies—especially the so-called nauseous genera *Danais* and *Euplœa* (vide Fryer, P.Z.S., September 1913, pp. 613-619)—may be commended to observers in the field.

In spite of the wide range of distribution I am unable to distinguish any geographical races.

Dicrurus macrocercus peninsularis Ticehurst.

Dicrurus macrocercus peninsularis Ticehurst, Bull. B.O.C., vol. liii, No. ccclxii (November 1932), p. 20—Madras City.

Specimens collected:—94 ♀ 20-4-29 Kurumbapatti; 308 ♂ juv. 312 O ? juv 2-6-29, 415 ♂ 15-6-29, 426 ♂ juv Chitteri range 3,000 ft.; 480 ♂ 24-6-29 Tirthamalai 1,000 ft.; 493 ♀ 3-7-29, 505 ♂ 4-7-29 Kalai, Trichinopoly; 726 ♂ 21-8-29, 753 ♀ juv 757 ♀ 26-8-29 Palkonda Hills 1,000 ft.; 817 ♂ 14-9-29 Kodur; 953 ♂ 1-11-29 Nallamallai range 2,000 ft.; 1126 ♂ 11-12-29, 1151 ♀ 21-12-29, 1165 ♂ 23-12-29 Cumbum valley; 1204 ♂ 8-1-30, 1221 ♂ 10-1-30 Godaveri Delta.

Measurements[1]:—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
10 ♂	22.5-25	128.5-145	97-102	150-156.5	19-22 mm.
4 ♀	23-25	131.5-138	93-96.5	143.5-144	20-21 mm.

In addition to the above specimens Dr. Gravely of the Madras Museum kindly collected a series of King Crows at Madras for the Survey.

The Survey did not procure specimens of the Black Drongo or Common King Crow in the Vizagapatam area but Ball (S.F., vii, 211) cites Jeypore in his list of localities for it. It is probably generally distributed and resident down the whole of the Eastern side of the Presidency though the only published records refer to Madras itself where Dewar has recorded some interesting notes on its habits (J.B.N.H.S., xvi, pp. 364-366 and 486). Hume obtained it on Rameswaram Island (S.F., iv, p. 458). In Travancore it is common both in the plains and at low elevations in the hills.

In the rest of the Presidency we certainly require more information about the King Crow and it is not improbable that there some of the birds belong to a different race and are seasonal visitors only. In Coorg, according to Betts, it is exceedingly common in the cold weather, but disappears almost entirely in the hot weather and does not become numerous again until September. He is doubtful whether any breed in Coorg. William Davison says that it occurs sparingly in the Wynaad and says the same of the Nilgiris (as also Bulger, P.Z.S. 1866, p. 569). This may be one of the species which has spread with the opening up of the hills, for Mr. Betts informs me that it is now 'a dry weather visitor to the Nilgiris where it is fairly common on the plateau (where Davison says it does not occur) from October to March and very common on the slopes. It does not seem to breed anywhere in the district and, at any rate in the west, is absent during the S.-W. Monsoon'.

Morgan (Ibis, 1875, p. 317) says that in the Nilgiris and South India the King Crow breeds from March to the end of May but there may be some error so far as the Nilgiris are concerned.

In Travancore the breeding season is said to be June to July. Aitken mentions a nest at Madras in June and Dewar one in August. La Personne saw a nest with eggs at Kurumbapatti on April 9th., and he procured nestlings in June in the Chitteri range.

The identification of the specimens of *Dicrurus* and *Chaptia* collected by the Survey has been made for us by Dr. C. B. Ticehurst who is working on this group. As he is publishing his conclusions in full elsewhere it is unnecessary to include or make critical notes here.

Dicrurus longicaudatus longicaudatus Jerdon.

Dicrurus longicaudatus Jerdon, Madras Jour. Lit. Sci., xiii, pt. ii (1845), p. 121—Segour Pass, Nilgiris.

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[1] In my experience in birds with forked tails the depth of the fork is often a racial character. In such species therefore I propose to give separately the measurements of the central and outer tail feathers. Unfortunately when originally measuring up the King Crows I did not realise the importance of keeping adult and 1st year birds separate. The series is now dispersed and I am unable to make good a deficiency which robs the measurements of these genera of much of their value.

Specimens collected:—74 ♀ 17-4-29 Kurumbapatti; 1014 ♀ 16-11-29 Nallamallai range 2,000 ft.; 1402 ♂ 17-2-30 Anantagiri 3,000 ft.; 1457 ♀ 2-3-30, 1604 ♂ 26-3-30, 1644-1645 ♂ ♂ 2-4-30 Sankrametta 3,000 ft.; 1695 ♀ 17-4-30, 1699 ♀ 18-4-30, Jeypore Agency 3,000 ft.

Measurements:—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
4 ♂	26.5-28	134-146	86-99.5	145-159.5	17-18.5 mm.
5 ♀	25.5-28	123.5-146	88.5-98	124.5-157	17-18.5 mm.

The Ashy-grey Drongo does not appear to have been recorded previously from the eastern side of the Presidency and the above specimens provide our only records. Mr. La Personne remarks of the Vizagapatam Hills that the birds were in pairs by the 17th. March though the organs were then not enlarged. By the latter end of April organs were developed. He ascertained from local enquiries (though one must remember that the various species of King Crows are often confused) that the birds were resident in this tract, moving only down to the foothills and adjacent plains in winter.

On the western side the bird is better known though we are as yet in ignorance of its real status. In Coorg according to Betts, who probably refers to this form, an Ashy Drongo is moderately common though it disappears almost entirely in the breeding season. In the Wynaad it is also said to be uncommon but in the Nilgiris it is fairly generally distributed at all heights also apparently as a winter visitor. Kinloch says that it is extremely common in the Nelliampathis. In Travancore it is said to be common both in the low country and at all elevations in the hills.

Jerdon's statement that he found eggs in April in Lower Malabar provides the only suggestion that the bird breeds in this area and I feel personally very doubtful of the various records that state it breeds on the Western Ghats north of the Presidency. I have had personal experience of the difficulty of separating some of the Drongos in the field and Hume showed how several good observers had failed to separate nests of Drongos and Black Bulbuls.

Further careful notes on the distribution and status of the Drongos in the Presidency are badly required.

Dicrurus caerulescens caerulescens (Linn.).

Lanius caerulescens Linn., Syst. Nat., ed. xii (1766), p. 134—Bengal.

Specimens collected:—2 ♀ 9-4-29, 57 ♂ 15-4-29, 175 ♂ 3-5-29 Kurumbapatti; 748 ♀ imm. 25-8-29 Palkonda Hills 1,000 ft.; 790 ♂ imm. 3-9-29, 827 ♀ imm. 18-9-29 Kodur 500 ft.; 921 ♀ 14-10-29, 926 ♀ 18-10-29 Seshachalam Hills 2,000 ft.; 992 ♂ 9-11-29, 1022 ♂ 1024 ♂ 22-11-29, 1006 ♀ 13-11-29, 1028 ♂ 24-11-29 Nallamalai Hills 2,000 ft.; 1110 ♀ 14-12-29 Cumbum Valley.

Measurements:—

	Bill.	Wing.	Central tail.	Outer tail.	Tarsus.
7 ♂	22.5-24.5	122-129	...	113.5-125	18-19.5 mm.
7 ♀	21.5-24	118-124	...	112.5-125.5	18-20 mm.

There is no record of the White-bellied Drongo in the Presidency north of the Cumbum Valley and the Nallamalai Hills where it was procured by the Survey. Howard Campbell records it from Ramondrug in Bellary district (J.B.N.H.S., xvii, p. 248). South of these localities it seems very generally distributed and common as far south as Kurumbapatti and specific records need not be cited. Below that we have no information. In the whole of this area it is probably resident.

On the western side of the Presidency William Davison says that it occurs in the Wynaad; at the foot of the Nilgiris and on their lower slopes. Jerdon says he met it at the Segour Pass and also at a high elevation in the Nilgiris. He met with it most numerously in the Wulliar jungles. In the Lower Palnis and the Pittur valley it is also common. A juvenile bird dated 27 August 1893 from Kuranmulti, Travancore (J. P. Cook) is in the collection of the Bombay Natural History Society.

At Kurumbapatti La Personne found a nest with two young in May. There is no other record of breeding dates in the Presidency as Howard

Campbell unfortunately omitted this detail in his account of breeding at Ramondrug and Horsleykonda.

The available series from Bengal is very small and defective but so far as it goes our birds agree with it.

Chaptia aenea malayensis Blyth.

Chaptia malayensis Blyth J.A.S.B., vol. xv. (1846) p. 294—Malacca.

Specimens collected:—203 ♂ juv. 11-5-29, 251 ♀ 19-5-29 Shevaroy Hills 3,500-4,500 ft.; 295 ♀ 30-5-29, 323 ♀ 3-6-29, 344 ♀ juv. 6-6-29 Chitteri range 2,000 ft.; 1381 ♂ 12-2-30, 1396 ♂ 16-2-30 Anantagiri 3,000 ft.; 1520 ♀ 11-3-30, 1522 ♂ 17-3-30, 1563 ♀ 17-3-30, 1639 ♂ 1-4-30, 1665 ♂ 5-4-30, 1681 ♂ 13-4-30 Sankrametta 3,000-3,500 ft.

Measurements:—

	Bill.	Wing.	Tail.	Tarsus.
♂	20.5-22.5	117.5-123.5	106.5-115	13.5-15 mm.
♀	21-22.5	113-117.5	104-111	14-15.5 mm.

The Bronzed Drongo is well known as a common resident species in the western side of the Presidency. Jerdon records it from the Malabar Coast and there are 2 specimens from Calicut (16-2-26 R. Foulkes) in the collection of the Bombay N. H. Society. William Davison informs us that he frequently saw and shot it near Ootacamund and also in the Brahmagherries of Coorg, but that in this area it is much more numerous in the lower ranges. It is not uncommon in the Nelliampathis and in the Palnis. Fairbank considered it one of the most common species at the base of the hills and up to 5,000 ft. In Travancore it is said to be common both in the low country and in the hills at all elevations.

On the eastern side it does not seem to have been recorded and Mr. La Personne's specimens from the Shevaroys, Chitteri hills and Vizagapatam hills are an extension of range. In the latter, however, it was to be expected as Jerdon met with it in the neighbouring Bustar State. Nothing has been recorded about the breeding season in the Presidency but in the Shimoga district of Mysore eggs were taken on 5 April (N. & E., i, 211). Dr. Ticehurst informs me that he cannot separate the Survey series from *C. æ. malayensis* (Malacca) and this bird, therefore, affords another example of the well-known fact that birds from the extremities of the horseshoe of countries round the Bay of Bengal are often alike.

Dissemurus lophorhinus (Vieillot).

Dicrurus lophorhinus Vieill., Nouv. Dict. d'Hist. Nat. nouv., ed., vol. ix (1817), p. 587—Africa *errore*, restricted to Ceylon.

This species, the type and sole member of its genus, has hitherto been considered peculiar to Ceylon, but in the *New Fauna* (vol. ii, p. 373) it is stated to occur also in South Travancore, apparently on the authority of Mr. Stewart. There is a point in connection with it which may be commended to workers in the field.

Readers of Legge's Bird of Ceylon will recall his observations, illustrated with woodcuts, on what he calls an abnormal adult variety of *Dissemurus paradiseus* found in the north of the island and which he suggests may possibly be a new species. His collection is in the British Museum and there is no difficulty in identifying the specimens to which he refers as they are marked on the labels as belonging to his abnormal variety. I have examined these specimens very carefully and find that they differ from specimens of *Dissemurulus* only in one detail, that the former possess and the latter lack a conspicuous gap or emargination on the inner web of the outer tail feather. This emargination is variable in extent and often irregular as between the two feathers, and after a prolonged examination I am satisfied that all the specimens belong to one form in which the presence or absence of the emargination is purely a matter of individual variation. The point then remains: are all these birds specimens of a monotypic genus or are they merely immature specimens of *Dissemurus para-*

diseus. Legge held that *Dissemurus* took 2 or 3 years to become adult. I can find no evidence of this. The first year bird after the postjuvenal moult does not have the well-developed crest and bare rachis and racket of the adult. Instead it has a moderate crest and an elongated outer tail feather with an emargination on the inner web, in other words it differs merely from the specimens we have been considering in an exaggeration of the feature already discussed and shown to be variable. After the next complete moult there is nothing to distinguish it from the adult and to suggest that birds with shorter racket feathers are younger than those with longer racket feathers is pure guess work. It is just as possible that the high specialisation of one feature in a family which is prone to other high specialisations of feather structure is marked by the tendency towards variation which presumably existed as the forerunner of that specialisation. In this case, therefore, I see no difficulty in believing that the birds with the plain outer tail feather, the birds with the emarginated outer tail feathers and the birds with the somewhat elongated emarginated tail feather represent one variable stage of one species namely *Dissemurus paradiseus* and that *Dissemurus lophorinus* is merely a synonym of *D. p. ceylonensis*. Careful field work will soon settle the point.]

Dissemurus paradiseus malabaricus (Latham).

Lanius malabaricus, Latham, Index. Ornith., vol. i (1790), p. 66—Malabar.
Specimen collected:—229 O ? 16-5-29 Shevaroy Hills.
Measurements:—Bill 37; wing 154; central tail feather 137; penultimate tail feather 159; racket feather 317; racket 75; tarsus 26 mm.

The Malabar Large Racket-tailed Drongo appears to be rather generally distributed and fairly common along the western side of the Presidency. Jerdon records it at Cannanore. In Coorg and the Wynaad it is common. William Davison says that it is sparingly distributed on the slopes of the Nilgiris and there it occurs normally up to about 4,000 ft. and seldom over 6,000 ft. though Davison once shot one near Ootacamund itself.

In the Nelliampathis, Palnis and the Travancore hills up to about 3,000 ft. it is also common, and in the first named Kinloch remarks (J.B.N.H.S., xxxix, p. 294) on its habitual association with *Dendrocitta leucogaster*.

On the eastern side it is only recorded by the Survey, La Personne reporting it as more or less common in the hills and plains of the Salem district, a nest being seen high in a tree. The single specimen collected does not differ in any way from birds of the western side.

There is no doubt that there are two well-marked races of this Racket-tailed Drongo in India, a large bird with a very long crest in the north known as *D. p. grandis* and a smaller bird with a smaller crest in the south known as *D. p. malabaricus*. In Ceylon a still smaller bird with a rudimentary crest is known as *D. p. ceylonensis*. Outside our area further races have been recognised on details of crest and size, the typical form from Siam being a small bird with a small crest. On comparison I have failed to find any point of difference between our South Indian bird *D. p. malabaricus* and the Siamese *D. p. paradiseus* and my only reason for not at once including it in the typical form is that I think any revision of a highly specialised form such as this should not be piecemeal. There seems to be little doubt that the number of races recognized is too large and that this species will be found to agree with other members of the family in evolving on parallel lines in different areas from a common centre. In a highly specialised feature such as the racket tail-feather there is room for a good deal of individual variation and care must be taken to allow for this range of variation in assessing the races.

Dissemurus paradiseus grandis (Gould).

Edolius grandis Gould, P.Z.S., 1836 (9 April 1836), p. 5—Nepal.

I have seen no specimens from the Presidency of this form but Jerdon states that he has seen them from the Nellore ghats and Gumsoor. This form certainly occurs as far south as the Godavery valley so the statement as regards Gumsoor may be accepted. Birds from the Nellore ghats, on the other hand, I should have expected to belong to the southern bird.

Chibia hottentotta (L.).

Corvus hottentottus Linn., Syst. Nat., 12th. ed., vol. i (1766), p. 155—Cap b. spei *errore*: restricted to Sikkim.

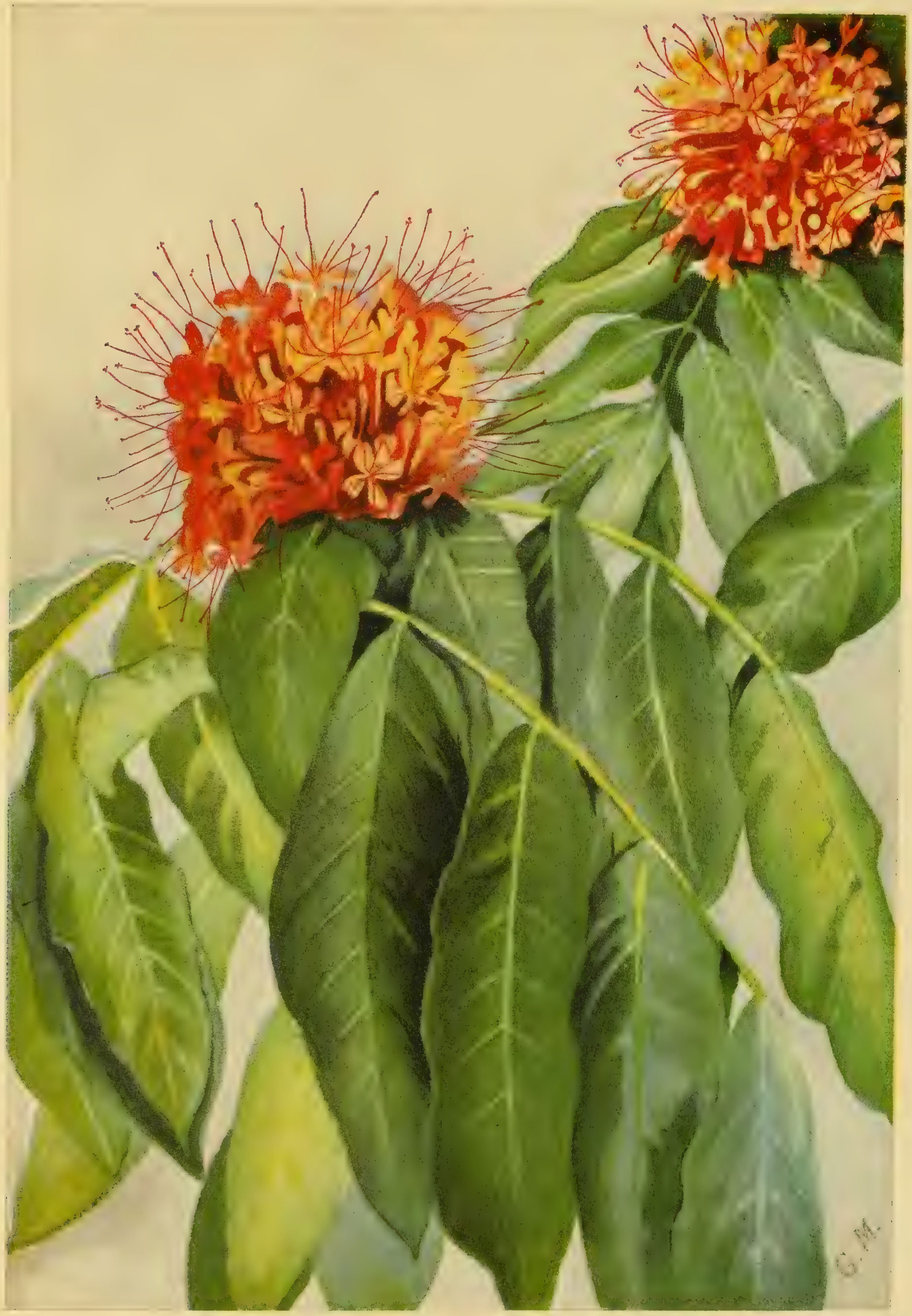
The Hair-crested Drongo was not met by the Survey and it is only known to occur in a small area of the western side of the Presidency. Two specimens are recorded as having been shot at Cannanore in March 1871 and 22 October 1872 (Vipan S.F., i. 495). William Davison unfortunately gives us no detailed information, only saying that it is very rare in S. India and that he only met with it 2 or 3 times and always at the flowers of *Bombax* (S.F., x, 367) and there are no specimens of his in the British Museum to supplement this information.

Jerdon, however, says that 'Captain Roberts of the 36 M.N.I., first made known the existence of this bird in Southern India, he having found it in Coorg; and Lieut. (now Lieut.-Col.) Blake also shot it in the same locality. I procured it afterwards from the Eastern ghats as mentioned (Madr. Jour., xiii) and since that have procured it in Malabar.' (B. of I., i, 439). He goes on to say that he saw it in the Wynaad. The occurrence in Coorg has since been confirmed by Mr. Betts (J.B.N.H.S., xxxiii, p. 546) though he calls it rare, only two or three pairs being seen.

There has been a good deal of trouble over the type locality of this form. In the Novitiates xxvi, (1919) p. 44 the type locality is restricted to Sikkim by Mr. Stuart Baker but as Kloss says (Jour. F.M.S. Mus. vol. x, (1921) p. 222) the selection of a type locality should have at least the appearance of probability; and on that ground Kloss disregarded the selection of Sikkim and chose Siam—this for the reason that *Cuculus* (*Dissemurus*) *paradiseus*, also used by Linne and Brisson, was definitely stated to have come from Siam. In the *New Fauna* vol. ii, (1924) p. 370 Sikkim was still maintained as type locality, in spite of Kloss' correction, but although arguments might be adduced for maintaining the original restriction to Sikkim, however inappropriate, Mr. Stuart Baker apparently did not desire to avail himself of them. At any rate in vol. vii (1930), p. 164 he gives a new type locality as Travancore with no word of explanation why Siam can be disregarded if Sikkim is not maintained. Travancore is if possible more unfortunate still. The distribution of the Hair-crested Drongo in Western India was given in the *Old Fauna* as 'The Western Coast of India from the Wynaad to Mahableshwar'. This distribution agrees with my own researches into the records. In the *New Fauna* it is given as 'Travancore, Malabar and Bombay Presidency'. If there is any evidence that the bird occurs in Travancore it does not appear to have been published. In any case it must be as a straggler only as neither Bourdillon nor Ferguson met with it.

As Kloss is of opinion that Himalayan birds differ from S. Indian and Siamese birds the correct name of those found in the Presidency depends on the solution of the above tangle. As I have no fresh specimens for examination I leave the problem to others, though in my opinion the restricted type locality of Sikkim must stand, however unfortunate it may be.

(*To be continued*).



John Bale, Sons & Danielsson, Ltd London

THE ASOKA TREE.
Saraca indica, Linn.
(½ nat. size.)

SOME BEAUTIFUL INDIAN TREES.

By E. Blatter, s.j., ph.d., f.l.s., and W. S. Millard, f.z.s.

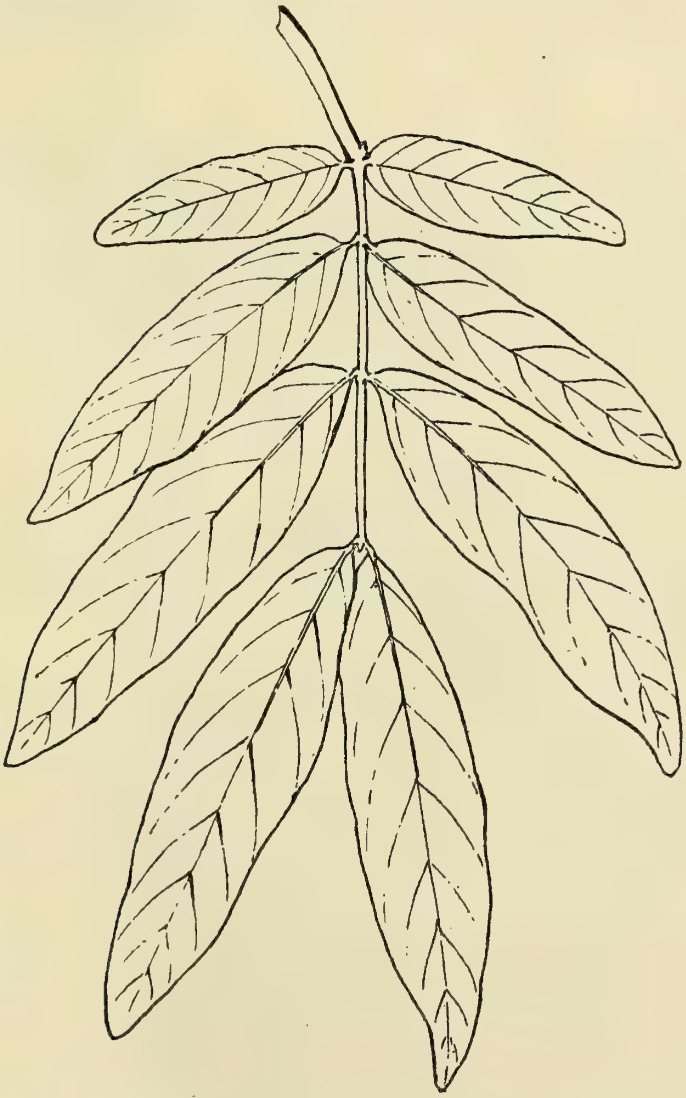
Part XI.

(*With one coloured and one black and white plate and 2 diagrams.*)
(*Continued from page 140 of this volume.*)

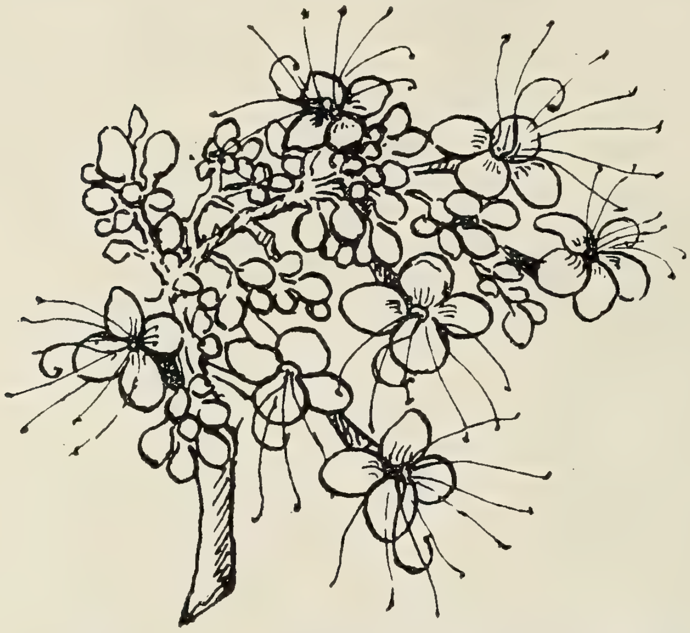
The Asoka Tree.

Popular Names.—Asok (Hind.); Asok, Asoka (Beng.); Aseka, Ati (Cuttack); Asok (Uriya); Asoka (Manipur); Asok (N.-W. P. and Pb.); Asok, Ashok, Asoka, Jassundi, Jasundi (Bomb.); Ashoka (Mar.); Ashopalava (Guz.); Asek, Kankeli (Tel.); Ahsunkar, Asoka, Asoge, Ashoka (Kan.); Thawgabo (Burm.); Diye ratembela, Diyaratmal (Sing.); Asoka, Kankeli, Vanjula (Sans.).

Saraca indica Linn. Mantiss. (1767) 98.—*Jonesia Asoka* Roxb. in As. Res. iv (1795) 355. (The origin of *Saraca* is somewhat doubtful. Bailey derives it from *Sarac*, the name of the genus in India; Chibber says it comes from an American name. This is most unlikely, as all the species of *Saraca* are natives of tropical Asia. There is, besides, the fact that Linnaeus coined the name *Saraca* as early as 1795.).



Description.—A small evergreen tree with an erect trunk covered with smooth dark brown or greyish brown bark. Its branches, spreading in every direction, form an elegant close-leafed crown. The leaves grow alternately on the branches. They are sessile, being without a pedicel or foot-stalk. The leaf is about a foot in length. The midrib is smooth and round and carries 4 to 6 pairs of leaflets without a terminal leaflet at the apex. The leaflets are smooth and glossy, firm in texture with slightly waved margins. The tree is interesting as furnishing an example of drooping young leaves without chlorophyll, like those of certain other evergreen trees, for example, *Amherstia nobilis*, *Mesua ferrea*, *Mangifera indica*, *Polyarthia fragrans* and others. The young leaves are red in colour, thin and flaccid, and hang vertically downwards for some time after attaining full size. The flowers appear in large compact clusters which spring direct from the heavy branches or from the slender terminal twigs. On opening, the flowers are a bright orange and later turn red giving each cluster a richly variegated tone. In full bloom, the Asok is beautiful; its orange and scarlet clusters of flowers contrasting richly with the dark branches and deep green foliage. The flower has a small red leafy bract at the base of the stalk; its calyx is formed of two small heartshaped bract-like leaves which mark the termination of the flower-stalk. The corolla is long and tubular, tapering at its base, funnel-shaped at the apex where it divides to form 4 oval petals. A fleshy annular ring on the summit of the corolla-tube bears 4-7 spreading thread-like stamens, crowned with small kidney-shaped anthers. The style is nearly as long as the stamens. The pod is from 6 to 10 inches long—fleshy red when unripe. It is scimitar-shaped and contains 4 to 8 smooth grey seeds the size of a chestnut.

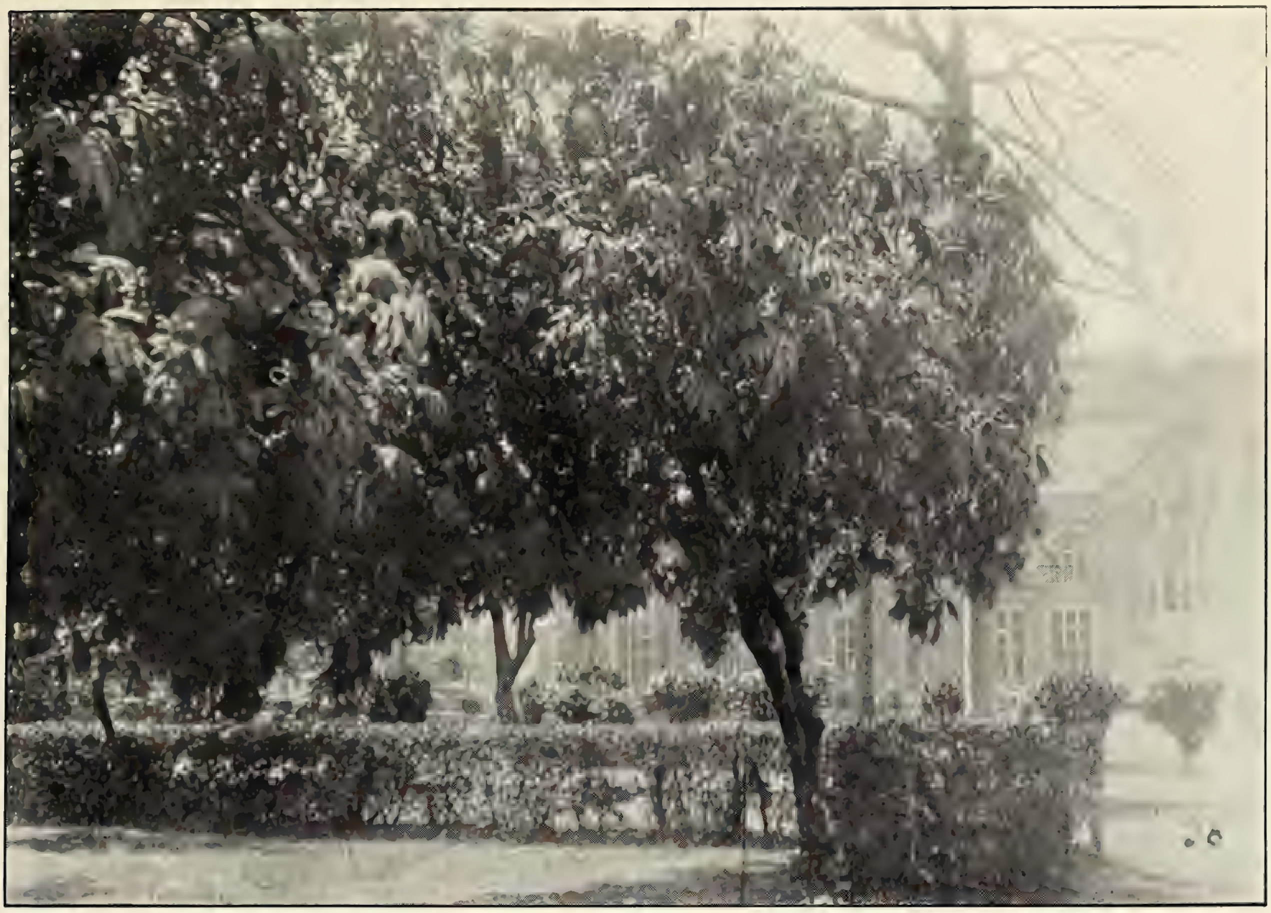


Flowers.—January to April or May.

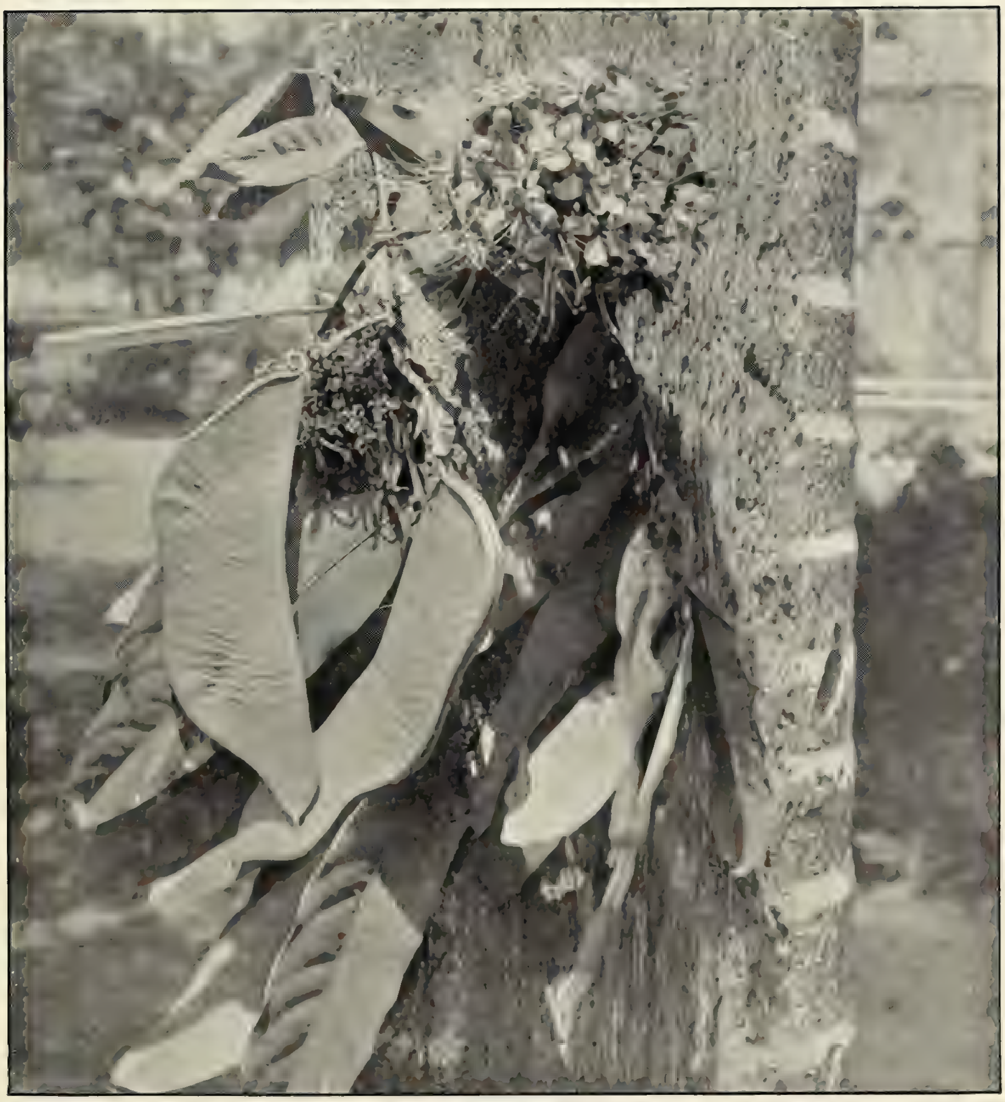
Distribution.—Found wild along streams or in the shade of the evergreen forests in the Khasia Hills, Chittagong, Arakan, Tenasserim, Upper Burma, the Northern Circars, and the W. Coast of Bombay, Ceylon, Malaya.

Uses.—In Medicine: The bark is much used by native physicians in uterine affections, and especially in menorrhagia. A decoction of the bark in milk is generally prescribed. A *ghrita* called *asoka ghrita* is also prepared with a decoction of the bark and clarified butter together with a number of aromatic herbs in the form of a paste. In Orissa the bark is said to be used as an astringent in cases of internal haemorrhoids.

In Religious Practices: The Asoka is one of the sacred trees of the Hindus which they are ordered in the Urapaj to worship on the 13th day of the month Chaitra, i.e., 27th. December. Its flowers, probably on account of their beauty and the delicacy of their perfume which in the months of April and May is exhaled throughout the night, are much used in temple decoration. 'The tree is the Symbol of Love, and is dedicated to Kama, the Indian



The Asoka Tree (*Saraca indica* Linn.)



Flowers and Fruit of the Asoka Tree (*Saraca indica* Linn.)

God of Love. Like the *Agnus castus* it is believed to have a certain charm in preserving chastity; thus Sita, the wife of Rama, when abducted by Ravana, escapes from the caresses of the demon and finds refuge in a grove of Asoka's. In the legend of Buddha, when Maya is conscious of having conceived the Buddisattva, she retires to a wood of Asoka trees and then sends for her husband.' The word Asoka signifies 'that which is deprived of grief' (Folkard, *Plant-lore and Legends*). Mason (*Burma and its People*), says the tree is held sacred among the Burmans because under it Gautama Buddha was born, and immediately after his birth delivered his first address.

(*To be continued*)

THE HYDERĀBĀD STATE ORNITHOLOGICAL SURVEY.

BY

SÁLIM ALI.

With Notes by HUGH WHISTLER.

PART I.

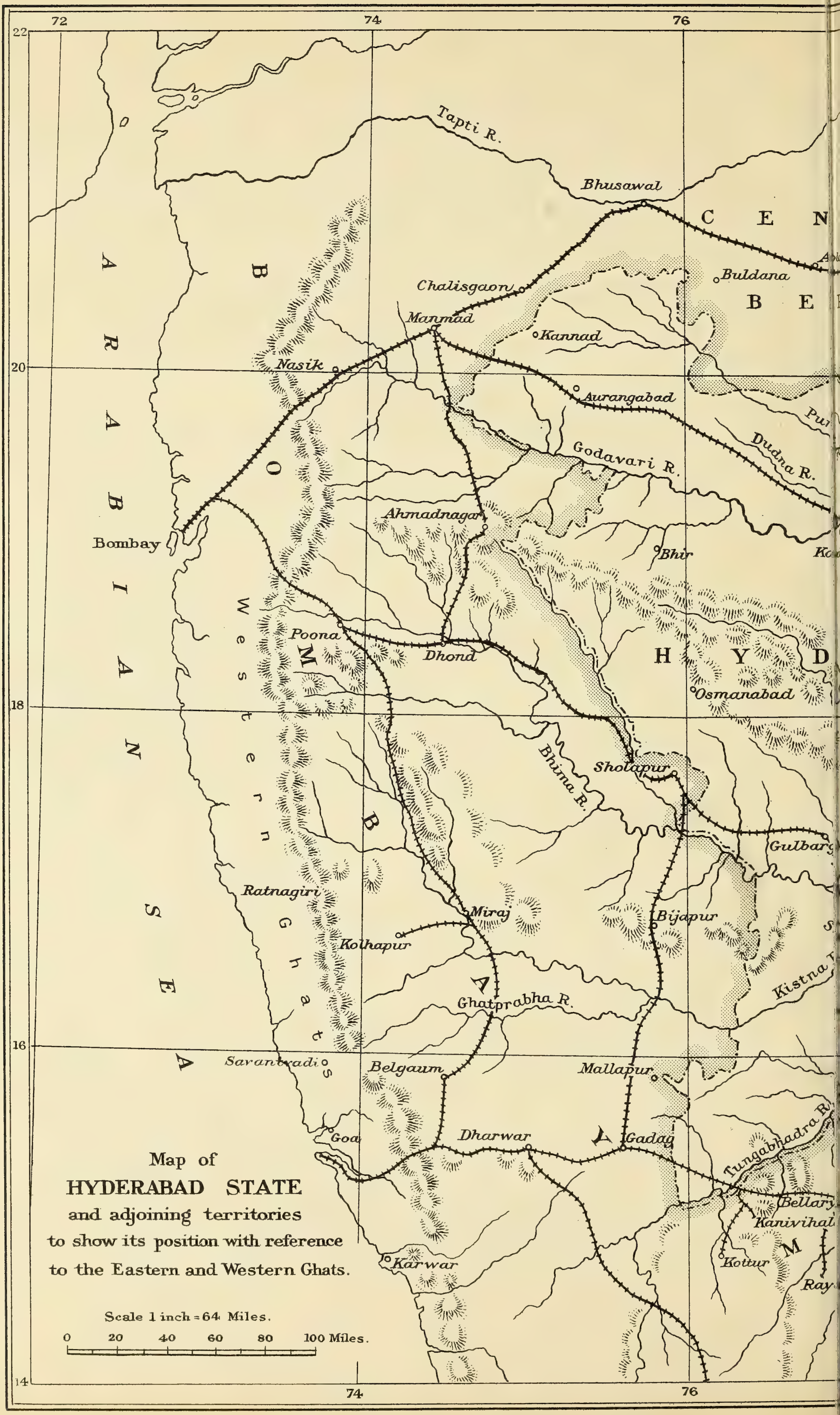
(*With a map and two plates.*)

Introduction.

The Hyderābād State is a large tract of country situated in the heart of the Indian Peninsula between latitudes 15°10' and 20°40' N. and longitudes 74°40' and 81°35' E.

From an ornithological point of view this territory, almost 1 2/5 the combined areas of England and Wales, had till now remained practically unexplored, a deficiency that had left its adverse impress on the *New Fauna*, especially in regard to the distributions of many peninsular races. The tremendous additions to our knowledge made by the recent bird survey of the Eastern Ghāts made it all the more desirable that a similar exploration of the Hyderābād State should be undertaken in order to fill in the picture that had now emerged, and efforts were launched by the Bombay Natural History Society to interest the Nizam's Government and induce them to finance the proposed survey. Unfortunately, however, the Hyderābād Government were committed at the time to other important schemes of a more urgent nature and could not see their way to lend the necessary support. Efforts to raise the requisite funds elsewhere proved likewise unavailing, and it appeared as though the survey would perforce have to hang fire until economic conditions improved generally.

Thus the matter stood when it occurred to me to approach the Hyderābād Government in a private capacity asking them if they would be prepared to extend certain facilities involving a very modest outlay in order to enable me to carry out the much needed survey of the bird life of the State. I offered in return to place at their disposal duplicates of all specimens procured which could serve as the nucleus collection for a natural history museum whenever they decided to have one. Thanks to the far-sighted and progressive policy of H.E. Maharaja Sir Kishen Pershad Bahadur, the President of the Executive Council, and of Sir Akbar Hydari, the Finance Member, my proposal found favour with the Hyderābād Museum Committee who contributed a sum of Rs. 1,000 towards my travelling expenses, and although this amount has long since been very considerably exceeded, I am grateful to the Hyderābād Government for really setting the ball rolling. I am also indebted to them for providing me with certain other facilities such as help from district Police and Revenue officials, without which, I soon discovered, it would have been impossible to get anything done for love or money!



Map of
HYDERABAD STATE
and adjoining territories
to show its position with reference
to the Eastern and Western Ghats.

Scale 1 inch = 64 Miles.

72
74
76
22
20
18
16
14
Tapti R.
Bhusawal
C E N
Buldana
B E
Chalisgaon
Manmad
Kannad
Nasik
Aurangabad
Dudna R.
Godavari R.
ARABIAN SEA
BOMBAY
Bombay
Ahmadnagar
Bhir
Western Ghats
Poona
Dhond
H Y D
Osmanabad
Bhima R.
Sholapur
Gulbarg
Ratnagiri
Miraj
Kolhapur
Bijapur
Kistna
Ghatprabha R.
Sarantvadi
Belgaum
Mallapur
Goa
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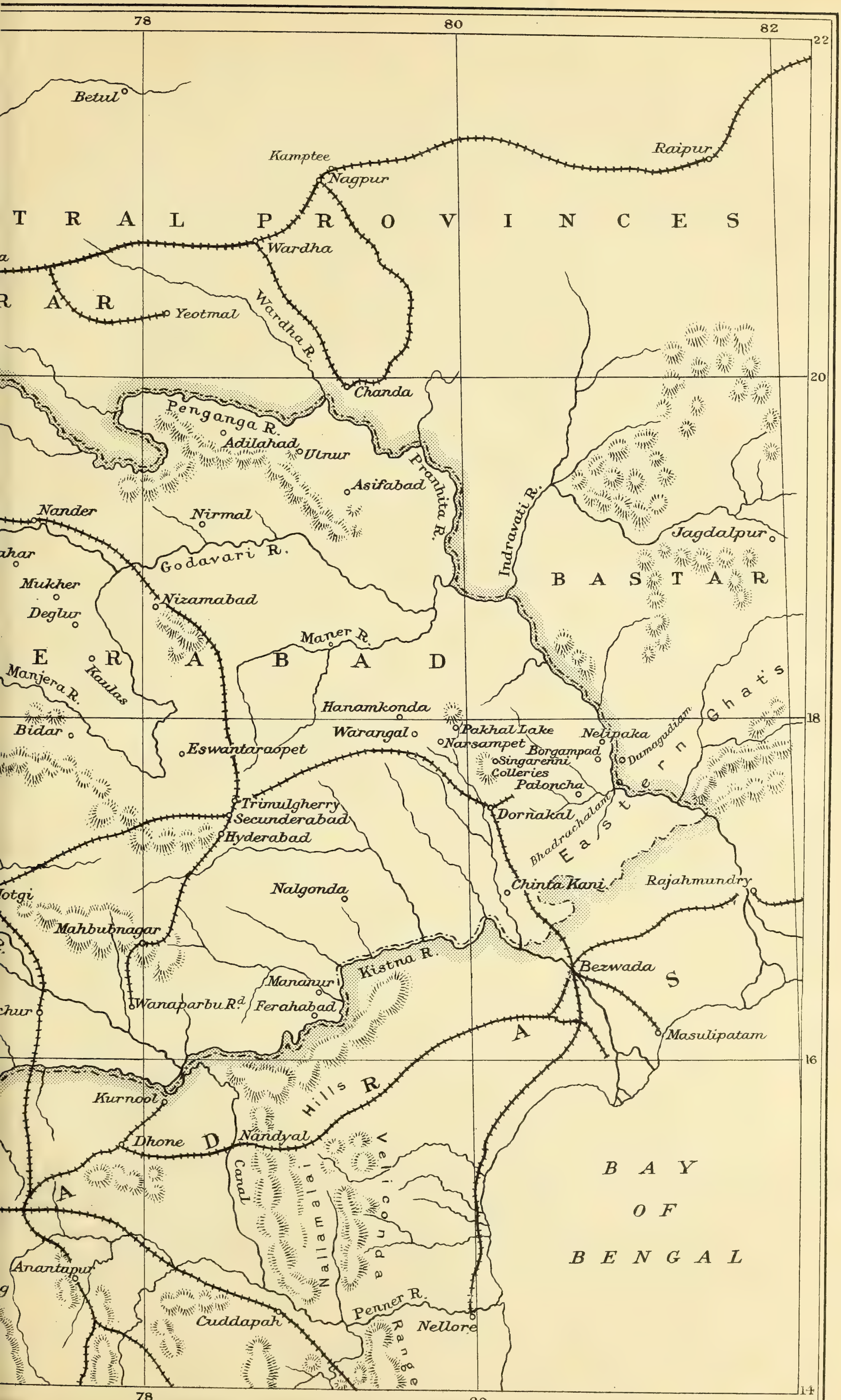

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Nagpur
Raipur
TRAL PROVINCES
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RAR
Yeotmal
Wardha R.
Chanda
Penganga R.
Adilabad
Utnur
Asifabad
Pranhita R.
Indravati R.
Jagdalpur
BASTAR
Nander
Nirmal
Godavari R.
Mukher
Deglur
Nizamabad
Maner R.
ERABAD
Manjera R.
Kaulas
Bidar
Hanamkonda
Warangal
Pakhal Lake
Narsampet
Nelipaka
Borgampad
Singarenni Colleries
Paloncha
Dumagudiam
Eastern Ghats
Eswantaraopet
Trimulgherry
Secunderabad
Hyderabad
Dornakal
Bhadrachalam
Chinta Kani
Rajahmundry
Nalgonda
Jotgi
Mahbubnagar
Kistna R.
Bezwada
S
Mananur
Wanaparbu Rd
Ferahabad
A
Masulipatam
Kurnool
Hills
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D
Nandyal
Velliconda Range
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BAY OF BENGAL
Anantapur
Cuddapah
Penner R.
Nellore

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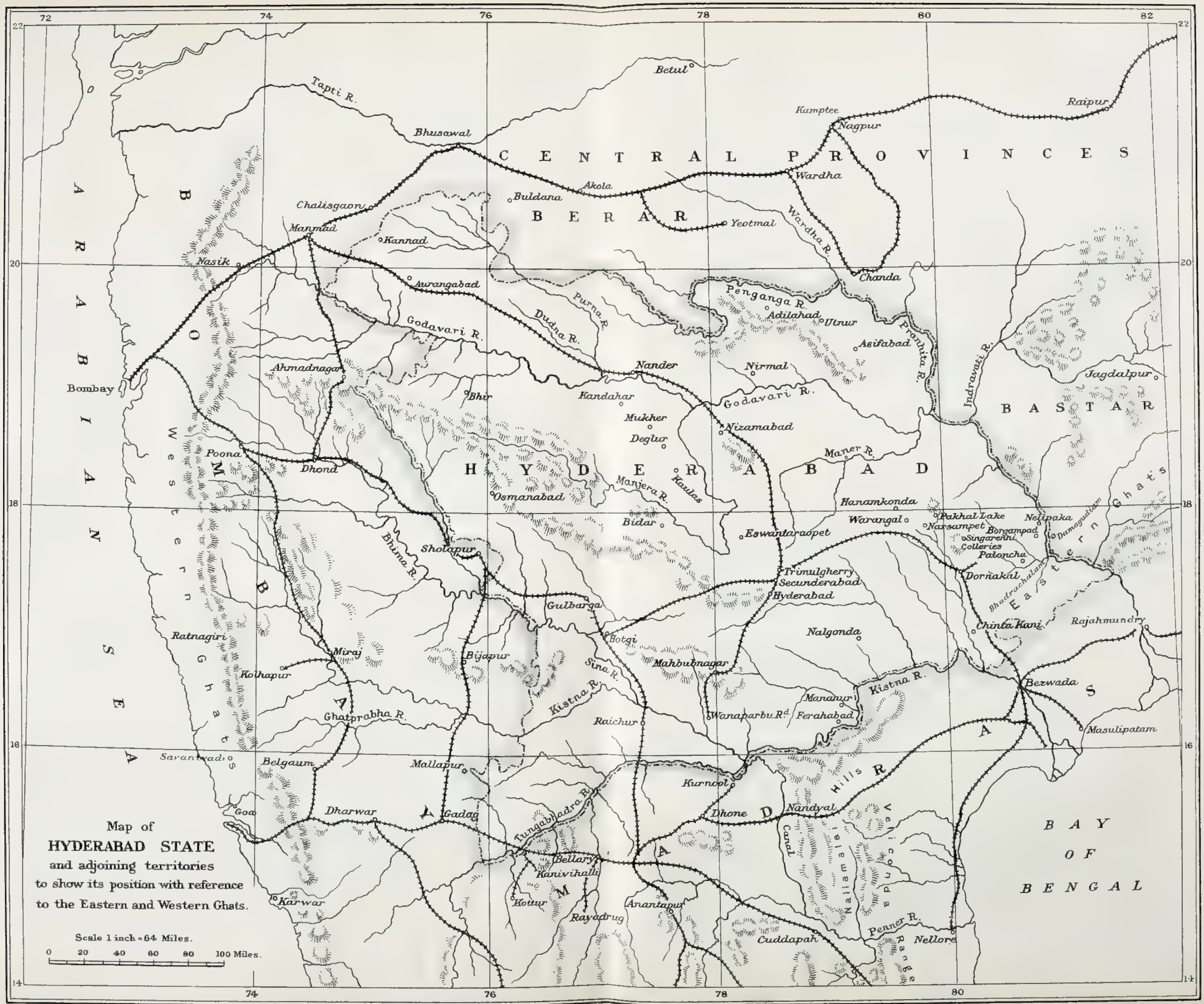
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Betul
Tapti R.
Kamptee
Nagpur
Raipur
Bhusawal
C E N T R A L P R O V I N C E S
Akola
Wardha
Buldana
Chalisgaon
B E R A R
Yeotmal
Manmad
Kannad
Wardha R.
Nasik
Chanda
Aurangabad
Penganga R.
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Dudna R.
Godavari R.
Pranhita R.
Asifabad
Indravati R.
Ahmadnagar
Nander
Nirmal
Jagdalpur
Bombay
Bhir
Kandahar
Godavari R.
B A S T A R
Mukher
Nizamabad
Deglur
Maner R.
Poona
Dhond
H Y D E R A B A D
Kaulas
Manjera R.
Osmanabad
Hanamkonda
Eastern Ghats
Pakhal Lake
Nelipaka
Warangal
Narsampet
Borgampad
Damagudiam
Bidar
Eswantaraopet
Singarenni Colleries
Bhima R.
Paloncha
Sholapur
Trimulgherry
Secunderabad
Hyderabad
Dornakal
Bhadrachalam
Gulbarga
Nalgonda
Chinta Kani
Rajahmundry
Ratnagiri
Hotgi
Miraj
Bijapur
Mahbubnagar
Sina R.
Kolhapur
Kistna R.
Bezwada
Manaunr
Kistna R.
Ghatprabha R.
Raichur
Wanaparbu Rd
Ferahabad
Masulipatam
Sarantvadi
Belgaum
Mallapur
Kurnool
Hills
Dhone
Nandyal
Goa
Dharwar
Gadag
Tungabhadra R.
Canal
Nallamalai
Velliconda Range
B A Y O F B E N G A L
Bellary
Kanivihalli
Karwar
Kottur
Anantapur
Rayadrug
Cuddapah
Penner R.
Nellore
A R A B I A N S E A
B O M B A Y
Western Ghats
M A D R A S

Map of
HYDERABAD STATE
and adjoining territories
to show its position with reference
to the Eastern and Western Ghats.

Scale 1 inch = 64 Miles.

0
20
40
60
80
100 Miles.

John Bale Sons & Danielsson, Ltd London.

In this connection, my special thanks are due to Mr. T. J. Tasker, C.I.E., O.B.E., I.C.S., and to Mr. Hasan Latif, M.I.C.E.E., for the interest they have shown and the trouble they have taken throughout in smoothing the work of the Survey.

With their unfailing readiness to assist their members and all workers in the field of natural history, the Bombay Natural History Society consented to lend me the services of one of their museum assistants, E. Henricks, in return for any of the Hyderābād material they might require to make their collections complete. I must here take the opportunity of recording my appreciation of the good work put in by Henricks in the field. It is in a great measure due to his painstaking labours that I was able to collect nearly 750 specimens during the five months I was on the work, and on the whole I think the preparation of the skins does him credit.

I am deeply indebted to Mr. Hugh Whistler for the endless pains he has taken over the examination and identification of the specimens, and for his valuable taxonomic comments thereon. These have been appended after each species in brackets with his initials. He has also contributed a number of notes from the literature dealing with neighbouring areas, wherever they appeared likely to throw light on the situation in Hyderābād. With his permission, I have taken the liberty of incorporating in my text any such notes of which I have made use. It has been a great privilege to have secured Mr. Whistler's collaboration since he has recently had the opportunity of working exhaustively at the material obtained by the Vernay Scientific Survey in the adjoining Eastern Ghāts area, which included both hill and plain birds and practically all the species met with in Hyderābād.

I was also fortunate in getting the assistance of my young cousin Humāyun Abdulali, a keen student of Indian birds, who joined me in camp during two periods of his college vacations, 13th October —7th November (1931) and 18th March—24th April (1932). As an enthusiastic birds' nester, the careful notes which he independently kept during these periods have been very helpful in my work. I look forward with hope to his future contributions to Indian Ornithology as a worker of the rising generation.

I am grateful to Mr. B. B. Osmaston, C.I.E., for the trouble he has kindly taken in the preparation of the map which accompanies this paper.

Our thanks are also due to Colonel R. Sparrow, C.M.G., D.S.O., for the loan of a large number of skins collected by him near Trimulgherry.

My original proposal to Hyderābād was merely to make a cursory survey of the bird-life of the Dominions, finishing it in 3 months' time. Experience at the very outset convinced me, however, that it was far more profitable to work a small area thoroughly than to try to rush through a preliminary survey of this great tract of country in the short time at my disposal, leaving the greater portions imperfectly explored. I placed these views before the President of the Museum Committee and appealed to him for such further adequate funds as would enable me to make a thorough job of the Survey. I suggested a period of one year as likely to be required for the purpose. The President, Maharaja Sir Kishen Pershad Bahadur, whose patronage of the Arts and Sciences is so well known, was inclined to favour the proposition, and although it had yet to be formally sanctioned by the Museum Committee I anticipated little opposition and commenced working on the new programme.

The Survey commenced work at Manānūr in the Mahbūbnagar District on 3rd October 1931 and was in the field till 20th December, after which there was a break till the end of February. Work was resumed on the last day of that month at Kandahār (Nānder District) but as by the end of April there was still no intimation from the Hyderābād Government regarding the question of finance, I was compelled to curtail my programme and return to Bombay.

It will be seen from the map that as a result of this curtailment practically the entire western portion of the State remains untouched. I had intended to have three collecting camps in this area, viz. Ajantā (Aurangābād Dist.), Southādā (Bhīr Dist.) and Gangāwati (Rāichur Dist.). This would have covered the State fairly thoroughly, but afterwards I had proposed to spend a further few months in the hilly portions, off the beaten track, to the extreme south and south-east of the State where I hoped to strike interesting inroads and extensions of the Eastern Ghāts avifauna. It was also my intention to penetrate further afield in other directions so as to cover every existing facies.

I hope at some future date the Nizam's Government will make it possible for me to take up the work at the point where it has now had to be dropped, and to complete the programme outlined above.

General Topography of Hyderabad State.

The Hyderābād State as it is to-day (excluding Berār) covers an area of 82,698 square miles. It forms a polygonal tract occupying almost the centre of the Deccan Plateau with an average altitude of about 1,250 feet above sea-level. The length diagonally from SW to NE is about 475 miles, and it has approximately the same breadth. The country generally slopes from NW to SE and the main drainage lies in this direction.

The Prānhitā River, known in parts of its course as the Pengangā, into which flow the Wardhā and numerous other tributaries, runs along the northern, and part of the eastern frontier. At Sironchā it merges in the Godāvari which thenceforth forms the eastern boundary. The two other principal rivers within the State, both of which also run into the Godāvari at different points, are the Mānjrā and the Manēr, each of which in turn have numerous smaller tributaries. The Krishna or Kistna River, with its tributaries including the Bhima and the Tungābhadra forms the other principal channel of drainage into which also numerous streams (considerable rivers during the monsoon rains) discharge their waters. It forms the southern boundary of the State for a considerable part of its length.

The country in some parts is mountainous, wooded and picturesque, in others flat and undulating. The most important hill ranges are: (1) the Bālāghāt Range running east and west from the *taluka* of Bilōli in Nānder District to that of Ashti in Bhīr District, i.e. a distance of about 200 miles within the State, (2) the Ajantā Range, known as such, is really a stretch of about 100 miles of the Sahyādris or Western Ghāts in the N.-W. corner, and (3) the Jālnā Range which runs for a length of about 120 miles from Daulatābād eastward in the direction of Jālnā. Besides these, many smaller ranges occur in the N.E., such as the Sātmāla and Nirmal Ranges with their many extensions, spurs and outliers. On the southern border, along the valley of the Krishna, the Amrābād Range runs more or less parallel with the Nallāmalāis.

The *Gazetteer* furnishes the following:—'The portion to the N. and W. belongs to the trappean region, that to the S. and E. being granitic and calcareous. The trappean or black-soil country, inhabited by Mahratti speakers, is a land of wheat and cotton. Telingāna or the granitic region is a land of rice and tanks. The trappean or black-cotton soil region is covered with luxuriant vegetation, with cliffs, crags and undulating hills. In the granitic and calcareous region the hills are bare of vegetation but the plains are covered with scattered brushwood of every description. Dome-shaped hills and wild, fantastic boulders and tors abound in many parts, giving the region a gloomy aspect. The soil derived from the granite is sandy and unlike the trappean does not retain moisture. Consequently the rivers in this region run dry during the hot season, and this gives rise to the necessity of storing water in artificial reservoirs, known as tanks, with which the whole of the Telingāna area is studded.'

These tanks for irrigation purposes, are generally formed by throwing an embankment across the lower end of a valley, thus causing the accumulation of water of such streams as may flow into it. There are over 18,000 of such tanks in the State, some of them very large as the one at Pākhāl which is at least 30 miles in circuit. The newly completed Nizāmsāgar Tank in the Nānder District covers an area of over 40 square miles and has a bund about 3 miles long.

These two geologically and ethnologically different divisions, nearly equal in extent, are separated from each other by the Mānjra and Godāvari rivers.

The mean temperature of the State is 81 deg. F. and the average rainfall between 30 and 32 inches annually. In 1931 the rainfall was exceptionally heavy, being in many places double the average. The mid-day shade temperature at Kaulās (Nānder District) was frequently over 100°F. in March.

In the following notes I have endeavoured to record the vegetational features of the various environments in particular detail. The importance of this from an ecological point of view is obvious, and I venture to hope that workers in other areas will in future also adopt this plan as far as possible. The interdependences between plant life and bird life have so far been little studied in India, and it is only data of this nature accumulated in connection with regional bird surveys that will enable, in course of time, advances to be made in this direction.

Particulars of Localities worked.

1. *Hyderābād City environs*, alt. ca. 1,800 ft., September 25—October 3, 1931.

Broken, slightly hilly country. Basalt and granite boulders of gigantic size presenting grotesque formations, piled and balanced on one another in a perilous manner. Tanks among the boulder hillocks: Mīr Ālam, Himāyatsāgar, Umdāsāgar and others. The intervening flat spaces under cultivation or covered with scrub jungle; large trees often absent, except where planted along roadsides, etc. Soil red, chiefly laterite and *moorum*. Ground where not stony, covered with short straggly grass. Principal trees: Nim (*Melia azadirachta*), Babul (*Acacia* sp.), and stunted date palms. The common Deccan shrub *Cassia auriculata* in yellow flower everywhere. Custard apple (*Anona reticulata*) growing freely amongst the boulder hillocks. Shrubs of *Wrightia tomentosa* R. & Schl. also very common in rocky country and along with Nim, almost universally parasitized by *Loranthus longiflorus* Desr.

2. *Manānūr*, alt. ca. 2,000 ft. (on Amrābād Plateau, Mahbūbnagar District) October 3—October 15 (1931).

In the Amrābād Reserved Forest consisting of mixed deciduous species (now in heavy leaf). Teak (*Tectona grandis*) and Nallāmaddi (*Terminalia tomentosa*) abundant, the latter growing to large size. Soil for the most part laterite. Hillsides thickly strewn with large loose stones (now hidden by tall grass) making walking difficult and unpleasant. Occasional clumps of thin Bamboo, specially on the hillsides and by forest streams. Country mostly hilly. Jowāri (*Sorghum vulgare*) cultivated on the 'flats'—the valleys—and intervening spaces covered with high grass or scrub jungle with thorny Acacia or *Zizyphus œnoplia* bushes predominating. Here and there small tanks and water-logged grassland formed in natural depressions by the late heavy rains, in which stunted Babul abundant. The hills on this plateau all flat-topped, rising one above the other, the summits forming extensive table-lands with open park-like country, water-logged stony grassland, dotted with small trees. Hillsides leading up to these plateaux covered with thick scrub and secondary jungle also large deciduous trees and occasional dense Bamboo clumps. They are cut up by numerous rocky nullahs, often thickly overgrown with thorn-brakes. Interspersed among the scrub jungle, on the 'flat', are trees of Mhowa (*Bassia latifolia*), Teak, Bijasāl (*Pterocarpus Marsupium*), Ippa (*Hardwickia binata*), Nallāmaddi (*Terminalia tomentosa* W. & A.), *Butea frondosa*, *Feronia elephantum*, and others. *Calotropis* bushes and *Marsdenia volubilis* T. Cooke common along the motor road and cart tracks. On many of the stony hillsides *Zizyphus œnoplia* and other thorny bushes growing in such profusion as to make the undergrowth almost impenetrable. Yellow-flowering shrubs of *Grewia flavescens* and *Cassia auriculata* common, also *Phyllanthus reticulatus*.

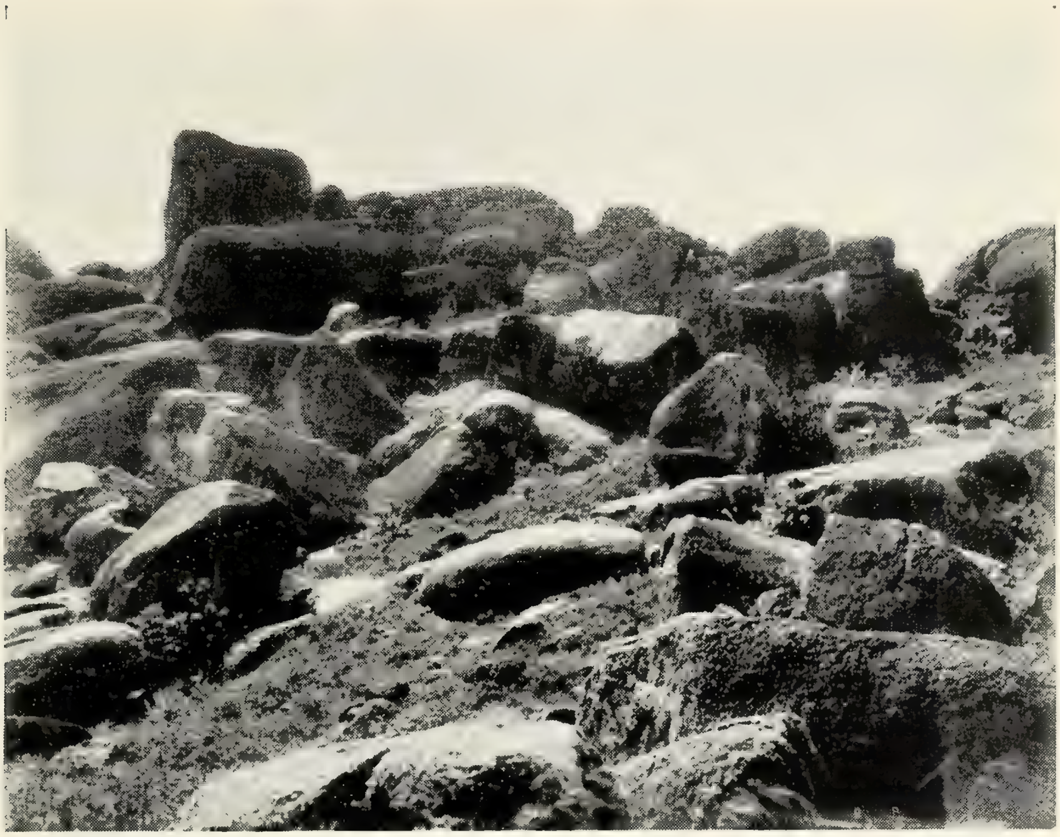
3. *Farāhābād*, alt. ca. 2,800 ft., October 15—October 20 (1931).

12 miles S. of Manānūr on another plateau rising above Amrābād Plateau. Country similar to Manānūr except on the whole more thickly wooded and containing a good deal more Bamboo. The Bamboo patches, especially where little rills and nullahs run through them, the facies richest in bird-life. Principal forest trees: Teak, Mhowa, Nallāmaddi, also a good deal of Chāroli (*Buchanania latifolia*). The last heavily and very generally infested with *Loranthus longiflorus* Desr. Mhowa with *L. elasticus*. Both here and around Manānūr *Cassia fistula* and *Butea frondosa* occurring in profusion, mostly as small stunted trees.

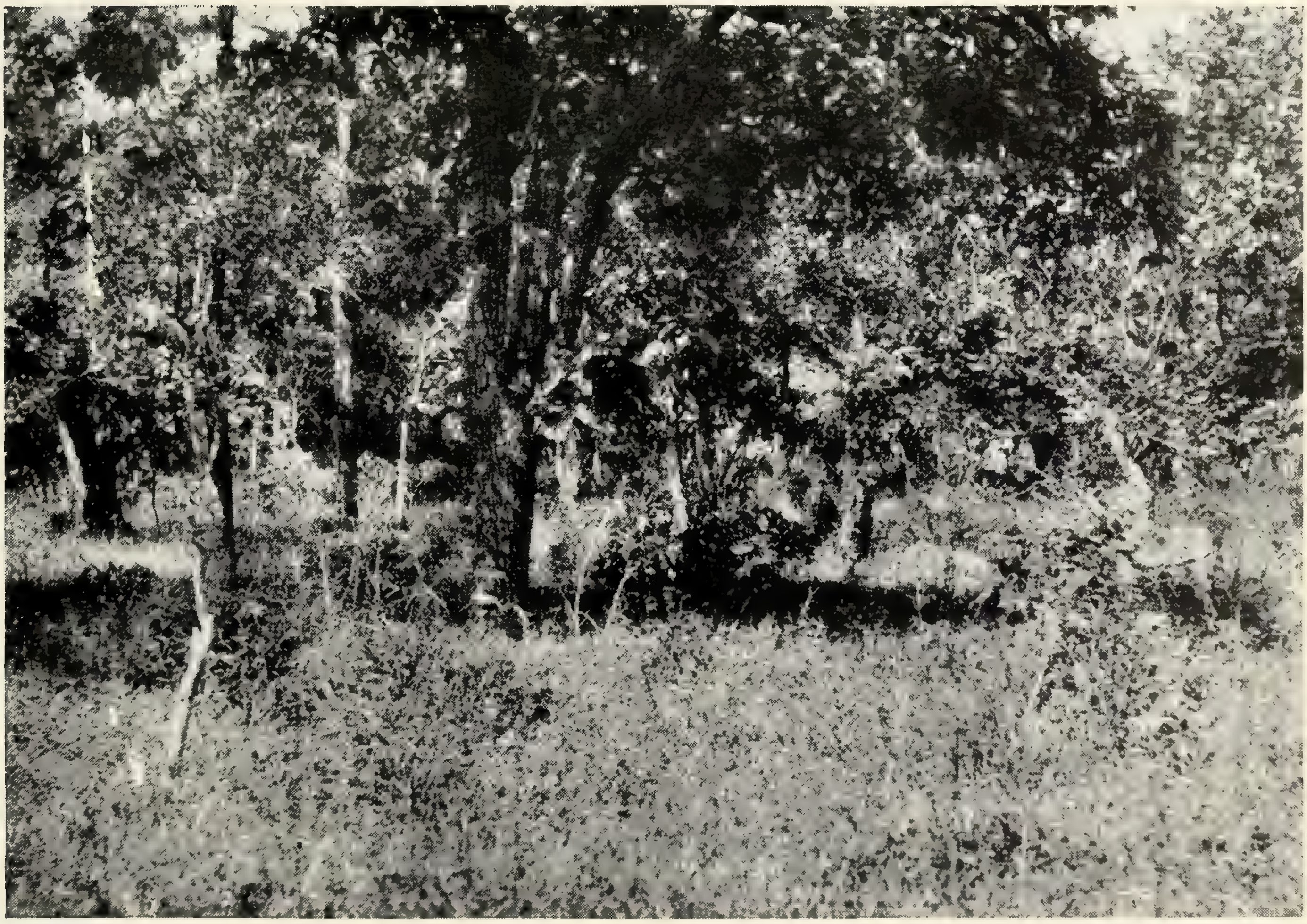
According to the *Gazetteer* among the birds found in the Amrābād forests are 'Red Parrots and Red Minās, and Yellow and Red Bulbuls as large as pigeons.' Unfortunately I failed to come across any of these enigmas!

4. *Borgampād*, alt. ca. 160 ft. (On the Godāvari River, opposite Bhadrāchellam in the Madras Presidency) October 29—November 7 (1931).

In the midst of flat cultivated country with a radius of 2-3 miles. Godāvari River about 1½ miles E of village. Steep muddy banks with deep and often tortuous outscourings thickly bordered by *Vitex pubescens* and other bushes. Beyond the ring of cultivation, laterite and *moorum* predominate, and dense secondary growth appears with much *Zizyphus œnoplia*. The country for a good distance on either side of the Kinārsāni—a tributary of the Godāvari into which it flows about 1½ miles E of the village—is scoured



(1) Typical boulder country, Hanamkonda (Warangal District).



Photos by Author.

(2) Typical country on the lesser Amrābād plateau.

by dry watercourses caused by the monsoon downrush of water to the river. The Kinārsāni at this season has numerous sandspits and shallow islets, the resort of terns, swallow-plovers and other waders. Along stretches of its banks typical riverain jungle is met with, consisting of *Z. œnoplia* with drooping and sprawling branches, and thick-set thorny shrubs of *Canthium parviflorum* Lamk. The bushes indicate the high flood level by their bare looping and twining stems and root-tangles, which canopied by the dense foliage form ideal haunts of flycatchers and other small birds. An exceedingly prickly species of Acacia with drooping pliant branches and cruel recurved thorns, plentiful. At intervals, upright lofty trees of a species of Ficus occur. *Randia malabarica*, with coral red berries and vicious long straight thorns, another common shrub. *Strychnos nux-vomica* Linn. of moderate size, also common. About 3 miles N of Borgampād in the direction of Nelipāka mixed timber- and scrub-forest begins, in places so dense at this season as to present an evergreen aspect. Principal trees: *Dalbergia sissoo* [largely parasitized by *Loranthus* (*longiflorus*?)], Teak, Ippa, *Feronia elephantum*, *Tamarindus indica*, and an Acacia with pink flowers. *Zizyphus œnoplia* by far the commonest shrub, now heavily laden with small round black (ripe) drupes.

5. *Nelipāka*, alt. ca. 160 ft. (9 miles N. of Borgampād, also on bank of Godāvari River, November 7—November 18 (1931).

For a radius of a mile or more around the village, flat cultivated country, fringed by dense scrub jungle giving place further to mixed deciduous forest with heavy undergrowth of seedlings and tangles of *Z. œnoplia.* Small grassy clearings interspersed in the forest. Hillsides enclosing the large bunded tank known as Tummalā Cherūvū (ca. 5 miles W. of village) strewn with loose stones and clothed in dense deciduous forest. Undergrowth at the base of these hills very heavy, comprised mostly of *Z. œnoplia* and an Acacia (*Mimosa lamata*?) with recurved thorns. Country broken up here and there by dry sandy overgrown watercourses caused by torrents rushing down from the numerous surrounding hills to the river after the heavy monsoon showers. On the banks of the Godāvari—which runs past—growing in water, are many dense and expansive 'Tamarisk' beds (*Phyllanthus Lawii* Grah.), haunts and roosts of Reed-Warblers, Blue-throats, Wagtails, Swallows and numerous other birds.

6. *Pāloncha*, alt. ca. 300 ft. (7 miles W. of Borgampād) 18—26 Nov. (1931).

Scrub and secondary jungle, extremely thick at this season, making for poor visibility. Tangles of *Zizyphus œnoplia* and the sprawling prickly bushes of *Mimosa lamata* extremely abundant. Pāloncha Hill, the highest of a number of forest-clad hills around is 1,181 ft. It has steep rocky sides, now heavily covered with dense shrubbed vegetation and tall grass. The heavy bush country at base, changes to mixed deciduous forest higher up the slopes. Above, among the tall grass, much Bamboo occurs. The smooth-barked Chīrwan or Tīrman (*Anogeissus latifolia*) is plentiful though mostly thin, also a fair sprinkling of straggly Teak. Jowāri and Rice cultivated on the flat country at the base of Pāloncha Hill. In the scrub jungle bordering cultivation *Bridelia Hamiltoniana* (var. *glabra*) is a very common shrub, 6-12 feet high. Its ripe slaty-black berries (now abundant) are a favourite food of Mynas, Green Pigeons, Bulbuls and a host of other species who act as important seed disseminators.

7. *Narsampēt*, alt. ca. 800 ft. (Warangal District) Nov. 29—Dec. 9 (1931).

Locality dotted over with numerous tanks. Owing to the abnormally heavy rainfall this season, nearly twice the average, much country surrounding these tanks is often submerged, there being practically no reed-beds around the margins. Tanks thickly covered with lotus leaves and other floating vegetation leaving only small patches of open water in the middle. In the intervening country *Butea frondosa* is the predominant species; there is a great deal of *Zizyphus œnoplia* now heavily laden with ripe berries, and *Borassus flabeliformis* palms by the hundred thousand. With the palms, a corresponding abundance of *Tachornis batasiensis* is noticeable. A large percentage of the palms are in the clutches of the 'Strangler Fig.', apparently *Ficus bengalensis*. In the country surrounding the tanks are small open grassy patches among the scrub jungle. Paddy is largely cultivated in this neighbourhood.

Six miles E. of Narsampēt is the Pākhāl Lake (17°57' N.×79°59' E.). This is enclosed on the N. S. and E. by ranges of low and densely wooded hills. On the W. side there is a dam thrown across the Pākhāl River which is about 2,000 yards long. The water covers an area of about 13 square miles and has an average depth of 30-40 feet. Water-channels run out at various points for irrigation purposes. The lake abounds with fish and crocodiles and the surrounding jungle with game. This is H.E.H. The Nizam's private 'Shikargah' and guns are strictly taboo. Through the kindness of Nawab Hamid Yar Jung Bahadur, the Inspector-General of Forests, special permission was accorded to the Survey for collecting in this area. Fine mixed deciduous forest surrounds the lake, intersected here and there by irrigation and seepage channels. Principal trees: Teak, Yerrmaddi (*Terminalia arjuna*, Bedd.)—some magnificent examples—a species of *Albizzia*, with lofty *Bombax malabaricum* at intervals. *Butea frondosa* also common. Marked abundance of lianas, the tangles of whose twisting woody stems form a favourite haunt of flycatchers, especially where overhanging streams. Large buttressed termite mounds a feature of this jungle, there being one or more every few yards. Mostly 6-8 ft. high, but some well over 10 ft. In portions of the forest Tapsi (*Holoptelea integrifolia* Planch), Gargoo (*Garuga pinnata* Roxb.), *Ægle marmelos* and Mhowa plentiful. The gigantic woody creeper, *Butea superba*, very common in the forest. In places a sparse lining of tallish grass at the water's edge, but no real reed-beds. In patches the ground is water-logged by the seepage and the forest here presents an evergreen aspect.

8. *Āsifābād* (formerly known as Jangāon) alt. ca. 1,200 ft. (Āsifābad District) Dec. 10—20 (1931).

In the Sātmāla Range. Country immediately surrounding town, open, cultivated—Jowāri, Linseed (*Linum usitatissimum*) and Castor (*Ricinus communis*). It is undulating and cut up by ravines and nullahs, the banks of which are heavily clothed with scrub. The vegetation in these patches consists mostly of *Z. œnoplia*, *Mimosa lamata*, saplings and stunted trees of *Cassia fistula* and *Butea frondosa*. An extremely common shrub is *Gymnosporia montana* Laws, diffuse, 6-8 ft. high, with crimson branches and petioles, and flowers that give off a mild fragrance. *Cassia auriculata* is everywhere, while *C. sophora* grows thickly in patches both in the jungle and around villages, forming vast fields as though deliberately planted. Beyond the cultivated zone lies a ring of low hills, 500-1,000 feet above the undulating plain which stretches for many miles, and gives the place the appearance of a shallow but enormous crater. At the foot of these hills there is a good deal of Bamboo of a more or less solid species. The hillsides are covered with deciduous forest interspersed with patches of scrubwood, and are scoured everywhere with ravines and nullahs, on the sides of which much thin Bamboo is present. Plants of *Goniocaulon glabrum* Cass. growing abundantly in a field, were observed to be largely attended by *Leptocoma asiatica* who were probing assiduously into the flowers for nectar. The hillsides are covered with tall grass and littered with loose stones. *Boswellia serrata*, *Feronia elephantum*, *Phyllanthus emblica* are common, also a species of stunted *Bauhinia*. Mhowa, also plentiful, is almost universally parasitized by *Loranthus longiflorus*.

9. *Kandahār*, alt. ca. 1,400 ft. (Nānder District) March 1—6, (1932).

Stony, undulating country with long gently-rolling hillocks, bare except for sparse stunted bushes mostly of a species of *Randia* and of *Gymnosporia montana*. In the 'valleys' or flats, Gram (*Cicer arietinum*), Jowari and Cotton (*Sorghum vulgare* Pers. and *Gossypium*) are largely cultivated, and in places on the summits of the flat stony hillocks a species of Hemp and some Tooar (*Cajanus indicus* Spreng.) are also grown. The principal trees are Nīm and Babūl (mostly stunted). Occasionally groves of Date palms are met, while Mango topes (*Mangifera indica*) are a common feature of the village environs. Here and there are also signs of the defunct fruit gardens which disappeared in a recent drought. Kandahār has a fine old fort said to date from the time of the invasion of Muhammad Tūghlak. There is a large tank in the village, very full and expansive after the heavy rains of last season, with no reed-beds. In among the ruined walls of the fort a good deal of Nim and *Phyllanthus reticulatus* is growing from the crevices, seeds of which have undoubtedly been disseminated by birds. Portions of the country in the environs of the village are overrun with Cobra cactus (*Opuntia*). In spite of the abundance of Mango trees, no *Loranthus* or Flowerpeckers were seen.

10. *Mūkhēr*, alt. ca. 1,350 ft. (18°42' N.×77°22' E.—18 miles S.-E. of Kandahār) March 7—10 (1932).

Black cotton soil country, undulating and cut up by lines of low rolling hillocks and shallow ravines. Similar to Kandahār. *Opuntia* grows in profusion in patches of the intervening country. *Erythrina suberosa* and *Butea frondosa* both coming into flower. Blossoms of both largely probed into by birds. Lining the banks of streams are groves and thickets of Date palms.

11. *Deglūr*, alt. ca. 1,350 ft. (18°33' N.×77°35' E.—Nānder District—about 16 miles S.E. of Mūkhēr) March 11—17 (1932).

Same type of country as at Kandahār and Mūkhēr. The river Lēndi a tributary of the Mānjra, runs through a rocky gorge about a mile N. of the town, and is here known as the Pātalganga.

No *Loranthus* was noted affecting the trees in the locality; neither were Flowerpeckers present.

12. *Kaulās*, alt. ca. 1,300 ft. (20 miles SE of Deglūr—Nānder District) March 17-28 (1932).

Rocky hills and ridges covered with deciduous jungle, at present mostly bare, with thin straggly Teak here and there. There is a fine old fort on a hill, at present in ruins and much overgrown with scrub. It has an extensive surrounding wall with many ramparts and battlements, favourite nesting sites of vultures, owls and other birds. Along the base of the fort hill winds the Kaulās River, a tributary of the Mānjra. Country to N. of fort: Rocky ridges of hills covered with light deciduous jungle. *Loranthus longiflorus* affects Nīm and other trees in great profusion; *Dicæum erythrorhynchum* observed feeding largely on the berries. *Gmelina arborea* common, now flowering. 'Kundagogi' (Tel.) (*Cochlospermum Gossypium*) trees, leafless, with large yellow flowers at the tips of the branches common. Among the hillocks are ravines and chasms with enormous boulders and yawning cavities and pits, often 20 ft. or more in depth, and long subterranean galleries which harbour many panther and bears. *Butea frondosa* and *B. superba* both common in the forest, now in flower and largely attended by *Leptocoma asiatica* and many other birds. At the base of the hills, the undulating country presents the same aspect as at Mūkhēr or Deglūr.

About 20 miles E of Kaulās on the way to Kāmāreddi Railway Station is the Nizāmsāgar Lake, a gigantic irrigation tank lately completed. It covers an area of about 40 sq. miles and has a dam 3 miles long. Rice is extensively cultivated in the neighbourhood with the help of the water conserved. The country surrounding is rolling and stony, with ravines, nullahs and low rocky hill ranges. Deciduous forest, quite thick in patches, devoid of leaf at this time of year. Mhowa (*Bassia latifolia*) is plentiful but almost universally parasitized by *Loranthus* (*longiflorus?*).

13. *Utnoor*, alt. ca. 1,250 ft. (Āsıfābād District) April 1—10 (1932).

Country similar to Āsifābad, mostly broken, with nullahs and ridges of stony hills covered with scrub jungle. There is open deciduous and high grass jungle to the N; dense mixed jungle to S; and dense jungle, high grass and scattered Bamboo among the hills to the E. Three large tanks in the vicinity of the village: Gopayya Cherūvū, Gangannāpēt Cherūvū and Nyārai Cherūvū. Principal trees: Mhowa, Teak, Charoli (*Buchanania*), Yerrmaddi (*Terminalia arjuna* Bedd.) on banks of forest streams, *Butea frondosa* etc. The large twining creeper *B. superba* is common, and bushes of *Calycopteris floribunda* plentiful in patches.

14. *Kannad*, alt. ca. 2,000 ft. (Aurangābād Dist.) April 15—18 (1932).

About 32 miles NW of Aurangābād and 18 from the famous rock caves of Ellora which are passed en route. Hilly, broken country similar to that at Kaulās. Extensive mango topes plentiful. Karonda (*Carissa karandas*) absent elsewhere in the State, appears in profusion. Also *Lantana camara*. Mango and Nim trees affected by *Loranthus longiflorus*. Sunbirds and Flowerpeckers in attendance.

15. *Bhāmarvāi*, alt ca. 2,500 ft. (Aurangābād Dist.) April 19—25 (1932). About 7 miles NW of Kannad, on the Outram Ghāt on the boundary between the Nizam's Dominions and Khāndesh, on the verge of the plateau overlooking Chālisgāon and the Khāndesh plains some 1,500 ft. below. The country is mostly hilly or broken and undulating deciduous forest in which Salāi (*Boswellia serrata*) is a very prominent species. It is almost universally parasitized by *Loranthus longiflorus*—the variety with crimson flowers. Mhowa (*Bassia latifolia*) and Charoli (*Buchanania latifolia*) are also very common.

I am obliged to Mr. K. Biswas of the Calcutta Herbarium and to Mr. C. McCann, Assistant Curator, Bombay Natural History Society, for the identification of my specimens of many of the plants mentioned in the above notes.

General Remarks on the Economic Status of Birds in the Hyderabad State.

Every State and Province in India maintains at great public expense an Agricultural Department for the improvement and development of agriculture, whose activities at the present time are mainly directed towards improving and evolving strains of crops to suit particular conditions, and towards researches in soils, manures and so on. To a lesser extent, perhaps, much useful work has been, and is also being, done in the investigation of the life-histories of many insect pests and field rats, and in devising ways and means—mechanical and chemical—to deal with the devastation caused by these vermin. Unfortunately, however, practically no attention is paid to the study of the economic value and importance of birds to agriculture. Economic Ornithology is a science which has received an increasing amount of attention within recent years in North America and in many European countries with excellent and far-reaching results. It is a research which concerns itself with striking a precise balance between the damage done by birds to agriculture and vegetation (which includes forestry), as against the active benefits they confer by the destruction of injurious animals and plants, and in sundry other ways. A passing acquaintance with the work of the Department of Biological Survey of the U.S.A. in this branch of investigations, and with that of similar institutions in European countries, is enough to convince the most sceptical of the boundless importance and possibilities of this study, and particularly in an agricultural country like India with its teeming bird-life, its significance cannot be over-estimated.

It is unfortunate that since the excellent work by Mason and Lefroy at Pusa on the Food of Indian Birds (Agricultural Dept. Memoir, Entomological Series, Vol. III, 1912) little systematic investigation has been undertaken in this country to determine their economic status. Even the above had as its principal object to discover which of our commoner birds inhabiting cultivated country were directly useful to agriculture by destroying injurious insects, and which species were responsible for active damage to crops and therefore injurious from this point of view. Within the limits of a single Memoir it was impossible to deal with the more subtle and indirect, but nevertheless considerable, influences exerted by the bird-life on its environment.

Without going into details, I wish to introduce here a few bare facts, casually gleaned from my work in connection with the

Hyderābād Survey, which I hope will suffice to indicate the diverse ways in which birds affect Man and his Agriculture in particular, and the entire Environment in general, for better or for worse, in this part of the country. While their influence is considerable and undoubted, a proper investigation into the life-histories of the different species, and an accurate determination of their exact status as beneficial or harmful can alone lead to devising steps to meet the situation.

Birds as Crop Destroyers.

At Manānūr, Pāloncha and other places I have remarked in my diary on the appalling ravages to ripening Jowari crops caused by Parrots. In the former locality—in fact all over the Amrābād Plateau—the Blossom-headed Parakeet (*Psittacula cyanocephala*) is a veritable scourge to the cultivator. I constantly noticed flocks of hundreds of this species, augmented by parties of the Rose-ringed Parakeet (*P. krameri*) engaged on their work of devastation, indifferent to the shouts and noises made by the ryots from their *machans* amidfield to scare them away, and studiously keeping out of range of the stones hurled at them through slings or *gophuns*. Nor were the parrots alone; bands and flocks of other birds, Mynas (both *Acridotheres tristis* and *Temenuchus pagodarum*) and Common and Jungle Crows joined in the work of destruction. The ryots were in despair. Enquiries showed that often 50 per cent, sometimes more, of their crops went as toll to the birds by day and to pigs and deer by night. From what I personally saw of the proceedings it seems a wonder how the birds left anything for the ryot at all!

My first experience of the Rosy Pastor (*Pastor roseus*) as a crop ravisher was in the Nāndēr District, where flocks of countless multitudes were observed descending in 'clouds' upon fields of ripening Jowari, supremely indifferent to the frantic protests of the ryots. To form an idea of the damage these birds must cause, I shot four birds at random out of a flock. Their stomachs and crops were packed tightly with Jowari grains exclusively which aggregately weighed one tola, which means that 160 birds would account for 1 lb. Considering the size of a flock—commonly 3-4 hundred birds or more— and the number of such flocks, and taking into account the extremely rapid digestion of birds and the fact that their depredations continue intermittently from daybreak till dusk, I think it would be a conservative estimate to say that a flock of 400 Pastors would account for 25 lbs. of Jowari in a day. The enormity of this damage can be better appreciated when it is remembered that this means the food of one villager for 10-12 days! To get an adequate idea of the damage they cause, it is necessary to see for oneself the hordes of Pastors as they descend upon the fields. However, against this must be set to the Pastor's account the benefit he confers by devouring locusts on a large scale in times of 'invasions'. In Uzbekistan (Russian Turkestan), from whereabouts many of our winter visitors certainly come, the nestlings have been ascertained to be fed practically exclusively on locusts in their various stages.

Birds as Crop Protectors.

While the parrots may be classed as wholly destructive to crops, and so also the crows to a large extent, the same cannot be admitted of the mynas. Mynas devour large numbers of locusts and caterpillars injurious to crops and thus compensate to some degree for the losses they cause directly. Among others that seem almost wholly beneficial to agriculture may be mentioned the King Crow (*Dicrurus macrocercus*) and the Indian Roller (*Coracias benghalensis*), both of which, but especially the former, were exceedingly common in the more cultivated tracts of the State. The Finches and Weavers occupy an intermediate position, for while the staple diet of the adults is grain, to obtain which they cause much loss to the ryot, their young on the other hand are nurtured more or less exclusively on insects and caterpillars, often captured in the very fields, which are in turn highly destructive to the crops. It must also be mentioned that this group is responsible for the destruction on a vast scale of the seeds of injurious weeds which they devour. Here, again, it remains for the economic ornithologist to determine the nett status of the various members of this group by careful research into their life-histories and feeding habits.

Equally beneficial with the King Crows, but in a less direct way, are the Birds of Prey, particularly the Owls and the smaller Falcons. This year (1932) there has been a severe plague of field rats and mice in a great many districts of the Mahrattwāda, and considerable damage has been caused to Wheat (*Triticum vulgare*), Gram and Jowar crops. I took particular care to examine the stomach contents of all the birds of prey I shot in the affected areas, for specimens or otherwise, and it is significant that in every case the birds were found to have eaten field rats and mice. The Horned Owls (*Bubo bubo*) indeed appeared to be living exclusively on these vermin. Besides stomach contents, I had numerous opportunities of examining 'pellets'. Among the rocks of the Pātalganga Gorge at Deglūr (Nānder District) where dwelt a small colony of these owls, the place was littered freely with the pellets cast up by them. An examination showed that they were composed to a great extent—in many cases exclusively—of the fur, bones and skulls of field rats and mice. Considering the ravages caused by these creatures to crops, often more than 50 per cent (and indeed in some of the places I visited certainly 75 per cent or even more!) and the astounding fecundity of this group, the importance of owls, harriers and kestrels as a natural check on their increase cannot be over-estimated.

Birds and Vegetation.

The status of birds in the regulation of the vegetation of any country is a complicated mixture of good and bad. The rôle they play is nevertheless of great importance. As cross-pollinators of flowers they are perhaps only second to the insects, but as agents of seed dispersal they stand in a class by themselves. A careful scrutiny of the details of the localities worked by the

Survey, and co-ordination with my field notes on the birds there met, will show that in many cases it is possible to connect the presence of certain plant species directly with the presence of certain birds. Thus, after dissection of numerous stomachs and close observation of the birds' feeding habits, I would unhesitatingly assign the profusion of such plants as *Zizyphus œnoplia*, *Bridelia Hamiltoniana*, *Buchanania latifolia*, *Phyllanthus reticulatus*, Nim (*Melia azadirachta*), *Ficus* of many species and others in a greater or lesser degree to the agency of birds which eat the berries and either transport the undigested seeds within their bodies to be passed out with the excreta at distant points, or disgorge them after a while through the mouth. The birds mainly responsible for the distribution of the above are: Bulbuls, Mynas, Babblers, Barbets, Hornbills, Green and Imperial Pigeons, even Grey Jungle Fowl, Flowerpeckers and a great many others. While in many cases this inter-dependence is not so readily traceable, in others it is more than obvious. The existence of the *Loranthus* tree parasite, for example, is inextricably linked with the occurrence of Sunbirds (*Nectariniidæ*) and Flowerpeckers (*Dicæidæ*) on whom it is dependent both for the fertilization of its flowers and the dissemination of its seed. It is significant that in Hyderābād wherever one member of this symbiotic partnership was present, the other was also invariably to be met, and vice versa.

Some of the flowers observed being probed into for nectar by Sunbirds and various other species are: *Bombax malabaricum*, *Erythrina indica*, *E. suberosa*, *Butea frondosa*, *B. superba*, *Opuntia*, *Grewia flavescens*, many of which, as I have already shown, are more than probably fertilized by birds. The case of *Lantana camara* needs careful watching. I only came across this species in the extreme western portions of the State (Aurangābād and Kannad). This pernicious weed has overrun thousands of square miles of the Indian continent within recent times, from plants imported into Ceylon for ornamental purposes, and from what we know of the partiality for its berries of Bulbuls, Mynas, Babblers and numerous other species, it seems to me likely that its spread over the rest of the State is only a matter of time. As an instance of the abundance in which its seeds are dispersed, I might mention that on one occasion in 3 minutes I observed an Oriole (*Oriolus kundoo*) to swallow 77 berries!

Birds as Scavengers.

The work of vultures and their ilk in the sanitation of villages and the prevention of epidemics and pestilence struck me as invaluable. With the complete absence of sanitary arrangements of any kind and where the entire population of a village is obliged to troop out early in the morning to attend to the calls of nature, often at no great distance from their hovels, it seems difficult to imagine what the situation would end in with all this accumulated

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[1] *Flower-birds and Bird-flowers in India*; Journ. Bomb. Nat. Hist. Soc., xxxv, pp. 573-605.

filth, augmented as it is by every other conceivable form of refuse, in the absence of the unfailing co-operation of Kites, Crows and Vultures. At Borgampād I had special opportunities of observing the speed and efficiency with which these birds cleaned up the village precincts. It was a feature of the place to see numbers of Scavenger Vultures (*Neophron percnopterus*) perched expectantly on stakes by the village in the mornings.

Apart from the human filth and garbage, I found that it was the usual custom in Hyderābād villages when a bullock or other animal died and the local *chamars* had removed their perquisites, to dump the carcase just outside the village precincts, there to putrify and befoul the air. During epidemics of rinderpest or other cattle diseases, when the mortality is often considerable, one shudders to think what the consequences would be in the absence of co-operation from the Vultures.

The swiftness with which a party of Vultures can dispose of a carcase is truly astounding. At Kaulās, I had occasion to test this. After the skins of two bears we had shot that morning had been removed, I had the carcases—which certainly could not have weighed less than 250 lbs. between them—dragged out into a field near camp where I wished to photograph the vultures at the feast. The rabble that dropped from the blue within an astonishingly short time consisted of the following species: *Pseudogyps bengalensis*, *Gyps indicus*, *G. fulvescens*, *Torgos calvus*, supplemented by a few *Neophrons*, Kites (*Milvus govinda*) and Crows (*Corvus splendens* and *C. macrorhynchos*). Altogether their number must have been between 60 and 70. From my photographing 'hide' I timed the proceedings and found that within the space of 40 minutes the birds had stripped the carcases so thoroughly that nothing but the bare bones were visible, and fresh-comers at this stage did not find it worth while to linger on the spot!

Systematic List.

FAMILY: CORVIDÆ.

Corvus macrorhynchos culminatus Sykes. The Southern Jungle-Crow.

Corvus culminatus Sykes, P.Z.S.. 1832 (July), p. 96—Dukhun = Poona.

Specimens collected:—203 ♂ 31-10-31, 206 ♂ 1-11-31 Borgampād 160 ft.; 267 ♂ 8-11-31 Nelipāka 160 ft.; 376 ♂ 26-11-31 Pāloncha 300 ft.; 442 ♂ 8-12-31 Narsampēt 800 ft.; 465 ♀ 13-12-31 Āsifābād 1,200 ft.; 595 ♂ 22-3-32 Kaulās 1,350 ft.; 717 ♀ 18-4-32 Kannad 2,000 ft.; 741 ♂ 23-4-32 Bhāmarvādi 2,500 ft.

Iris brown; bill, legs, feet and claws black; mouth slaty-black. In No. 206, mouth pink, tongue blotched with black.

The Jungle Crow is a generally distributed species in the Hyderābād State, being usually met in association with *C. splendens*, in the neighbourhood of villages and isolated homesteads in forest. It is invariably present at carcases of cattle lying by the roadside, also at tiger and leopard kills in dense jungle, whose whereabouts it helps to proclaim. In some localities it is destructive to ripening Jowāri crops.

Breeding:—On 18 March one was observed sitting on nest in a tall tree near Nizāmsāgar tank. Specimen No. 595 (22 March) had the testes enlarged to 13×9 mm.; in No. 717 the ovarian follicles were 1-2 mm. in diameter; No. 741 (25 April) had the testes 8×5 mm. On 3 April (Utnoor) one was observed carrying a stick in its bill and on 26 April (Kannad) a pair was noted in copula on the ground.

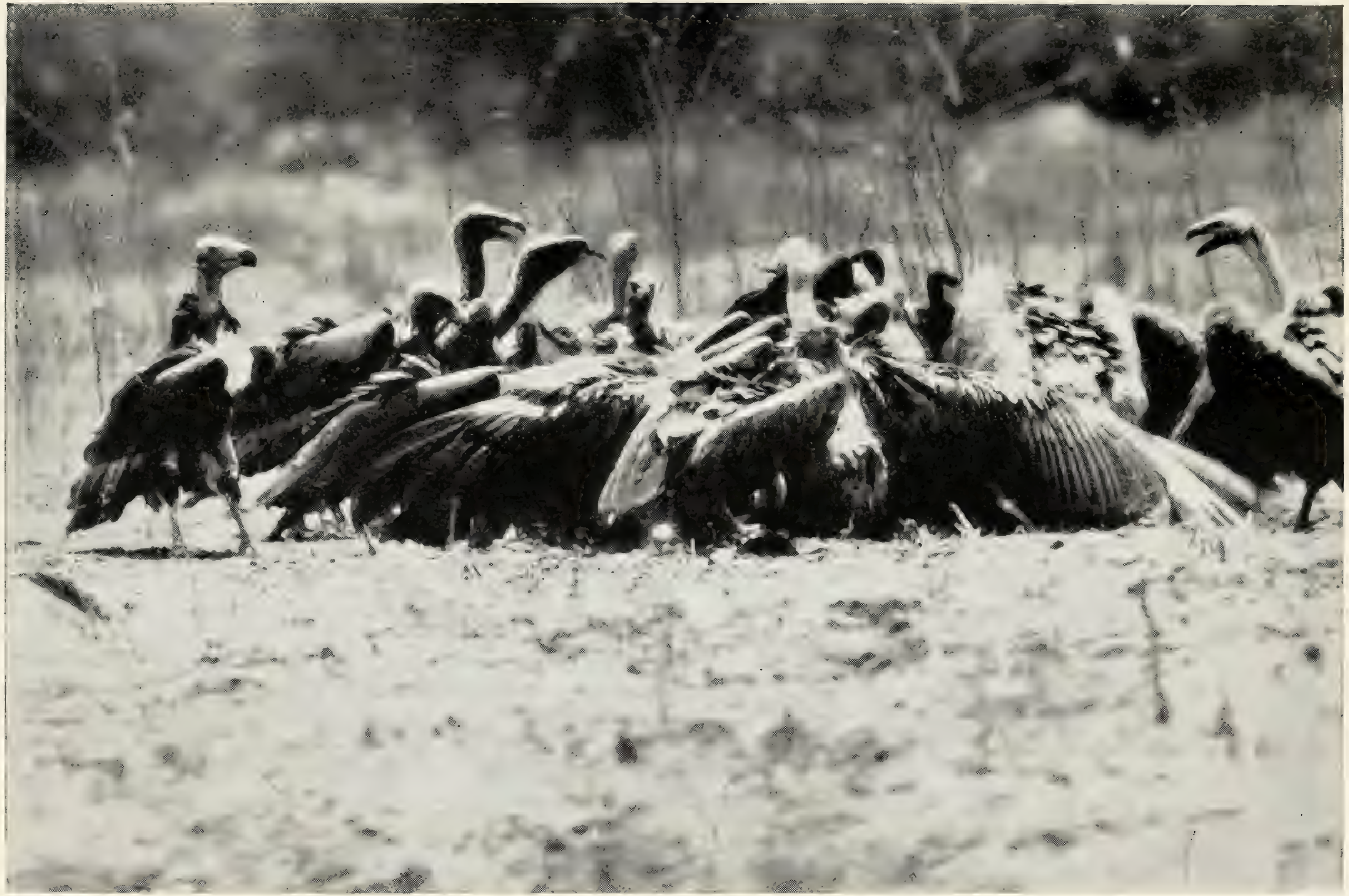

Photo by *Author.*

(3) Vultures at a wayside carcase.

From the above, it is evident that the breeding season was in progress in March and April.

Corvus splendens splendens Vieillot. The Indian House-Crow.

Corvus splendens Vieillot, *Nouv. Dict. d'Hist. Nat.* viii (1817), p. 44—Bengal.

Specimens collected:—204 ♂ 31-10-31 Borgampād 160 ft.; 303 ♂ 13-11-31 Nelipāka 160 ft.

Iris brown; bill, mouth, legs, feet and claws black.

Both birds are adult and completing an entire post-nuptial moult.

Invariably present as a commensal of man in towns and villages. Was not observed at Farāhabād (thick jungle with scattered Bhil homesteads) where only small numbers of *C. macrorhynchos* were in evidence. Excessively plentiful in and around Borgampād. In the evenings they regularly flew across the Godāvari River in small parties or large straggling rabbles coming from immense distances to roost, presumably at Bhadrāchellam on the opposite bank. A regular frequenter of *Butea* and *Erythrina* flowers and apparently an important agent in their cross-pollination. Several observed with a thick deposit of pollen on throat.

Breeding:—On 14 April (Aurangābād) a pair was seen building, but the birds did not seem in earnest and it was obvious that the season had not yet begun. In the Bheema Valley, according to Davidson and Wenden, it breeds from May to July.

Dendrocitta vagabunda vagabunda (Latham). The Indian Tree-Pie.

Coracias vagabunda Latham, Index Orinth., vol. i (1790), p. 171—India, restricted to Calcutta.

Dendrocitta vagabunda vernayi Kinnear & Whistler.

Dendrocitta rufa vernayi Kinnear & Whistler, Bull. B.O.C., cccxliv, vol. LI (1930) p. 17—Nallamalai Range, 2,000 ft., S. Kurnool.

(For the reasons for using *vagabunda* and not *rufa*, see Eastern Ghats Survey Report, J.B.N.H.S., vol. xxxv, p. 514.).

Specimens collected:—26 ♂ (imm) 5-10-31, 32 ♂ (imm), 33 ? (imm) 6-10-31, 122 ♀ (imm) 13-10-31 Manānūr 2,000 ft.; 160 ♂ 17-10-31 Farāhābād 2,800 ft.; 195 ? 30-10-31 Borgampād 160 ft.; 290 ♂ 11-11-31, 327 ♀ (imm) 16-11-31 Nelipāka 160 ft.; 353 ♀ (imm) 21-11-31, 364 ♀ 24-11-31 Pāloncha 300 ft.; 472 ♂ 15-12-31 Āsifābād 1,200 ft.; 590 ♀, 591 ♀ 22-3-32 Kaulās 1,350 ft.; 620 ♀ 1-4-32 Utnoor 1,250 ft.; 704 ♂ 17-4-32 Kannad 2,000 ft.

The mouth, slate coloured in the adult, is flesh-coloured in the young bird until well after the post-juvenal moult.

[This is an interesting series as it well illustrates the intergradation between the various races of this species. The three juveniles 26, 32, 33, and 122 from Manānūr and 160 from Farāhābād are, as one might expect, true *vernayi*. Nos. 590-591 Kaulās, 620 Utnoor, 472 Āsifābād, and 704 Kannad, as well as specimens from Eswantaräopet, Pattencheru, Mukhaid and Mallāpet which Col. Sparrow has kindly lent to me, are still very close to *vernayi* but already show traces of the passage into the larger *pallidus* of the N.-West. While Nos. 353 and 364 from Pāloncha, No. 195 from Borgampād and Nos. 290 and 327 from Nelipāka are markedly darker and, like Blanford's bird from Dumagudiam (just across the Godavari from these localities, vide Eastern Ghāts Survey J.B.N.H.S., xxxv, p. 514), though intermediate, are better classed with typical *vagabunda*)—H.W.]

Generally distributed in well-wooded country and open deciduous forest. A regular member of the localised bird associations in forest comprising numerous insectivorous species (Drongos, Babblers, Tits, etc.) which were a conspicuous feature of the Manānūr jungles and were also noted subsequently at Pāloncha and elsewhere. I shall, in future, refer to these mixed gatherings or hunting parties as 'localised forest associations'.

Tree-Pies move about singly or in pairs or family parties, and are very noisy, possessing a large repertoire of calls. Frequently observed feeding on Peepal (*Ficus religiosa*) and Gulair (*F. glomerata*) figs in an assorted company of Green Pigeons, Parrots, Mynahs, Barbets and other species.

Breeding:—The breeding season apparently either varies in the different portions of the State or is much prolonged. Specimens 26, 32, 33 and 122, all obtained at Manānūr between 5 and 13 October are immature birds with translucent and imperfectly ossified skulls. The first three were in company of their parents who fed them from time to time and created a commotion when they were shot. These birds are probably not older than a month and a half, which would take the laying of eggs back to about the end of August. 327 obtained on 16 November (Nelipāka) still had a partially soft skull, while 353 on 21 November also had the anterior portion of the skull in the same condition. In 590 (22 March, Kaulās) the ovarian follicles appeared to be developing (ca. 1 mm.) and on 23 April (Bhāmarvādi) I found a nest containing 4 hard-set eggs. 704 (17 April, Kannad) had the testes (slaty-pigmented) ca. 5×3 mm. and an incubation patch present.

The nest was situated in a vertical fork of a *Boswellia serrata* tree at a height of about 22 ft. on a densely wooded hillside. The eggs measured: 27×22, 29×22 (2) and 30×22 mm.

Col. Sparrow found it breeding commonly in the jungles 15-30 miles N.-W. of Trimulgherry where he obtained eggs from 27 April to 12 July. He considers the second half of June as the best time for fresh eggs.

A peculiar call uttered at this season is a long-drawn *Mee-aao* which I associate with breeding.

One remark regarding the 'localised forest associations' might here prove of interest. In regard to the South-Indian species of Tree-Pie (*Dendrocitta leucogastra*) I find it has been commented by several authors that it associates habitually with *Dissemurus paradiseus*. Whenever I came across *D. paradiseus* in the Hyderābād State, in 9 cases out of 10 it was as a member of these localised forest associations of which other unfailing members were *Dendrocitta vagabunda* and *Turdoides s. malabaricus*. After careful watching with a view to discover the reason of this association, I venture to suggest that it is merely a convergence of interests—apparently an abundance of food—that brings the different species together. This doubtless is the explanation for the alleged habitual association of *D. leucogastra* and *Dissemurus paradiseus* also. I had frequent opportunities of observing that in these gatherings the component members profited not a little by the efforts of others. For instance a Grey Tit, a Nuthatch or a Woodpecker scuttling along the trunk or branches of a tree flushed a moth resting securely upon the protectingly coloured bark which was promptly seized by a Drongo in waiting hard by, or a smaller insect similarly chased and captured by a Minivet or Flycatcher. Babblers rummaging down below among the fallen leaves also frequently discharged the function of beaters by disturbing winged insects seeking refuge on the ground.

FAMILY: PARIDÆ.

Parus major mahrattarum Hartert. The Southern Grey Tit.

Parus major mahrattarum Hartert, *Nov. Zool.* Vol. xii (September 1905), p. 499—Ceylon.

Specimens collected:—28 ♂ 5-10-31, 61 ♂ (imm) 8-10-31, 96 (♂) 11-10-31, 117 ♀ (imm) 13-10-31 Manānūr 2,000 ft.; 156 ♂ 17-10-31, 177 ♂ (imm) 19-10-31 Farāhābād 2,800 ft.; 265 ?, 266 ♂ (imm) 8-11-31, 272 ♂, 273 ? (imm), 274 ♀ 9-11-31, 285 ♀ (imm) 10-11-31, 306 ♀ (imm), 307 ♂ (imm) 14-11-31, 329 ? (imm) 16-11-31, 336 ♂ (imm) 17-11-31 Nelipāka 160 ft.; 347 ♀, 348 ? (imm) 20-11-31, 381 ? (imm) 26-11-31 Pāloncha 300 ft.; 417 ♂ 3-12-31, 429 ♂ (imm) 6-12-31 Narsampēt 800 ft.; 468 ♀ 14-12-31 Āsifābād 1,200 ft.; 574 ♀ 19-3-32 Kaulās 1,350 ft.

Elsewhere noted at: Kandahār, Mūkhēr, Utnoor, Kannad, Bhāmarvādi.

Iris brown; bill horny black; mouth pale pink; legs and feet bluish slate; claws dusky. In the juvenile the bill is horny-brown, commisure and lower mandible paler, but it rapidly becomes similar to that of the adult.

[In the above series the adult ♂ and ♀ are alike though the ♀ may usually be distinguished by having the black pectoral patch smaller, the central abdominal stripe narrower and both rather less glossy.

The juveniles of both sexes differ from the adults in having the black cap duller and almost without gloss, and the black pectoral patch and abdominal stripe smaller, duller and almost without gloss. The grey of the upper plumage is darker, more leaden in colour, with in some specimens a very faint greenish wash, that is they link up the two types of juvenile colouration referred to in the Eastern Ghats Report.—H.W.]

Common throughout the surveyed portions of the Dominions. Usually met with in small parties in deciduous forest, both hill and plain, clinging to the bark of trees or sprigs of leaves hunting insects and occasionally uttering joyous whistling notes. Almost invariably present among the localised forest associations, sometimes with *Machlolophus*.

Breeding:—A number of the specimens collected in October and November had the skulls imperfectly ossified, indicating that they were young birds of the season. The last, No. 574 (19 March, Kaulās) although its ovaries were in an undeveloped condition, was one of a pair, and my diary records that about this time the birds were oftener seen in pairs than heretofore.

Col. Sparrow obtained eggs in the Eswantarāopet jungles, near Secunderabad, between 5 July and 15 August. On 22nd July he found three nests with young.

The breeding season in Hyderabad is presumably between July and September.

I may here remark that the Key relating to this bird on p. 74, Vol. i of the *New Fauna* is totally unsatisfactory and misleading. Referring to the tail it states: '. . . black on both webs with narrow grey edges' but makes no mention of the outermost pair of feathers which is entirely white, and the second pair which is also largely of this colour! The question of the white in the tails and its subspecific value has already been dealt with by Dr. C. B. Ticehurst (J.B.N.H.S., xxxi, p. 491) and by Mr. Whistler in the Eastern Ghats Survey Report (J.B.N.H.S., xxxv, p. 518). In the Hyderabad series the white wedge on the inner web of the penultimate tail feather varies from 23·5 to 34·5 mm. and in one example is as short as 16·5 mm.

Moreover under the 'Description' of this race on p. 77, the *Fauna* says: '. . . the nuchal patch hardly noticeable and the tail feathers wholly black on both webs, with only narrow grey edges to the outer webs . . ' In the case of the Hyderābād birds, both in life and where the neck had not been telescoped in preparation of the skin, the white nuchal patch was by no means inconspicuous.

I kept a special look-out for *Parus nuchalis*, but failed to come across it anywhere in the State.

Machlolophus xanthogenys aplonotus (Blyth). The Yellow-cheeked Tit.

Parus aplonotus Blyth, *J.A.S.B.*, xvi (1847), p. 444—Chaibasa, Singhbhum.

Specimens collected:—34 ? (imm) 6-10-31, 66 ♂, 67 o? (imm) 8-10-31, 70 ♂ 9-10-31, 128 ♀ 14-10-31 Manānūr 2,000 ft.; 158 ♂ 159 ? (imm) 17-10-31, 170 ♂ (imm) 18-10-31, 172 ? (imm) 19-10-31 Farāhābād 2,800 ft.; 418 ♂, 419 - 3-12-31 Narsampēt 800 ft.; 679 ? 8-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Nirmal (Āsifābād District).

Iris brown; bill horny-black; mouth pinkish; legs and feet slaty-blue; claws darker. Soft parts similar in the juvenile, but the gape and mouth may be bright yellow.

[This series unfortunately does not completely clear up the problem with regard to the plumages of this species to which I drew attention in the Eastern Ghats Report (J.B.N.H.S., xxxv. p. 520), as several of the specimens could not be satisfactorily sexed.

There are only two specimens (Nos. 159 and 419) in which the black band from the chin to the vent is replaced by dull olive-green, and both of these unfortunately were not sexed. Their measurements and plumages however suggest that they are adult females.

Nos. 34, 66, 67, 128, 170, 172 which all appear to be in juvenile plumage or post-juvenal moult are all black breasted. I should not repose complete confidence on the sexing of these specimens but they at least show that the green stripe is not necessarily a sign of immaturity. Probably it will ultimately be proved that the sexes differ as regards the colour of the band at all ages.

The juvenile may be distinguished from the adult by the shorter feathers and less glossy black of the crown and crest; by the large yellow terminal spots on the median coverts, the yellow terminal spots and faint yellowish edges to the greater coverts and the much narrower tips and edgings to the tertiaries, the latter being pale yellow rather than white; and by the narrower, softer tail feathers with the white tips smaller and less pure.

These specimens provide a slight extension of the known range of this species and race.—H.W.]

The distribution of this bird within State limits appears somewhat patchy and local. After Manānūr and Farāhābād in the south, where it was common, it was not again met (though specially sought) until I got to Narsampēt where it was distinctly rare. Of the only pair seen in the compound of the Dâk Bungalow at Nirmal (29 March) one had the breast and abdomen jet black (♂ ?) and the other greyish-black (♀ ?). At Utnoor it was also noted as *not common.*

At Manānūr and Farāhābād (and elsewhere on the Amrābād Plateau) its joyous musical *chee-chee* was one of the commonest bird voices in the deciduous forest (hill and plain), and parties of four or five birds were invariably present amongst the localised forest associations.

Breeding:—The Yellow-cheeked Tit is a late breeder. In a diary of 1925 I find that on October 15 (at Utnoor) a pair were nesting in a tree-hole about 20 ft. from the ground. There is also a note to the effect that others of the species were in family parties at that time—parents with full-fledged young. None of the specimens obtained by the Survey show any genital development, but 5 of those obtained on the Amrābād Plateau beween 3 and 20 October are, judging from the condition of their skulls, young of the season. The birds here were also in family parties consisting of the parents and 3 or 4 young. From the above evidence and from records relating to neighbouring areas I would place the breeding season as between August and October.

The birds seen at Nirmal and Utnoor (29 March to 10 April) had paired off. A male was singing on 8 April. The song resembles certain snatches from that of *Saxicola caprata*, and the notes are more musical than those of *Parus*.

FAMILY: SITTIDÆ.

Sitta castanea castanea Lesson. The Chestnut-bellied Nuthatch.

Sitta castanea Lesson, Traité d'Orn., 1830 (September 25), p. 316—Bengal.

Specimens collected:—330 ♀ (imm) 16-11-31 Nelipāka 160 ft.; 575 ♀ (imm) 19-3-32, 588 ♂, 589 ♀ 21-3-32, 602 ♂ 23-3-32 Kaulās 1,350 ft.

Elsewhere noted at: Pâloncha.

Iris dark brown; bill brownish-black; grey on culmen near forehead and at chin; mouth pale pink; legs and feet slaty-brown.

[Not otherwise recorded from the Deccan.—H.W.]

Inspite of the special look-out kept for these Nuthatches, none were met at any of the other camps. It was rare at Pāloncha.

At Nelipāka, in the course of 10 days' collecting, only a single pair was met with in open deciduous jungle, running up and down and around the stem of a sapling. It was fairly common at Kaulās in the hilly deciduous country—mostly in pairs.

The note commonly uttered is a quick-repeated double *chilp-chilp*.

Breeding:—None of the above specimens showed any genital development. Nos. 330 and 575 were young of the season. In the former the skull was as yet unossified on 16 November, while the latter (19 March) was an older bird with merely two soft patches on the anterior portion of the skull. From this it would appear that the species breeds towards the end of the monsoon. Col. Sparrow, who found these Nuthatches fairly common in the Eswantarāopet jungles near Secunderabad, observed a pair building on 4 April and took fresh eggs on 22 July.

Sitta frontalis frontalis Swainson. The Velvet-fronted Nuthatch.

Sitta frontalis Swains., Zool. Illus., Ser. i, pt. i, 1820 (1 October), pl. 2—Ceylon.

Specimens collected:—151 ? (imm), 152 ♂, 153 ♀, 154 ♂ 17-10-31, 178 ♀ 19-10-31 Farāhābād 2,800 ft.

Elsewhere not noted.

Iris and skin round eye lemon yellow; bill coral red, tip of upper mandible brown; legs and feet brown with an orange tinge; soles of feet orange-yellow. Mouth in immature bird coral red, gape yellow.

[This is an addition to the known distribution vide Eastern Ghats Survey Report, J.B.N.H.S., xxxv. 523. It has not before been recorded from the Deccan area proper.—H.W.]

This Nuthatch was met with in heavy mixed Bamboo forest on hill-sides, usually in (family?) parties of 4 or 5—once only a pair. The call is a loud cheeping whistle, something between the notes of *Dicæum erythrorhynchum* and *Leptocoma asiatica*. This call is perhaps the latest diurnal bird note in the forest, being frequently heard well after dusk, even after *Gallus sonnerati* cocks have ceased crowing.

Breeding:—The gonads of the specimens were in an undeveloped condition. No. 151 (17 October) was a young bird of the season with the skull as yet soft. From this it would seem that its parents must have bred considerably later than the months mentioned in the *Fauna* (Vol. i, p. 133) or in the Eastern Ghats Report (J.B.N.H.S., xxxv, 523).

FAMILY: TIMALIIDÆ.

Turdoides somervillei malabaricus (Jerdon). The Southern Jungle-Babbler.

Malacocercus malabaricus Jerdon, Ill. Ind. Ornith., text to pl. 19, 1845 (March)—Malabar.

Specimens collected:—24 ♀ 5-10-31, 40 ♀, 41 ♂ 6-10-31 Manānūr 2,000 ft.; 185 ♂ (imm) 29-10-31 Borgampād 160 ft.; 641 ♂ 3-4-32, 659 ? (juv.) 6-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Fārāhābad, Nelipaka, Pāloncha, Narsampēt, Āsifābād, Kandahār, Kaulās, Kannad.

Iris creamy white; bill pale yellow; mouth and commissure near gape bright yellow; legs, feet and claws pale yellow.

In the fledging chick (No. 659) the iris is greyish-brown; bill brownish-flesh, lower mandible yellow; gape yellowish-cream; legs, feet and claws pale flesh colour.

Generally distributed throughout the State in both dense and open deciduous jungle as well as in scrub country surrounding cultivation. Also partial to the shady mango topes so abundant in the Nānder and Aurangābād Districts.

One of the most unfailing members of the localised forest associations giving away the presence of these gatherings by its harsh squeaks and squabbling. Contrary to the view expressed in the Eastern Ghats Report (J.B.N.H.S., xxxv, 740) I have time and again found it in association with *Turdoides striatus*. This was specially noted in my field diary at the time.

Fond of Peepal figs (*Ficus religiosa*) on which it feeds in mixed company, also of the round black drupes of *Zizyphus œnoplia* in the dispersal of whose seeds it assists to a considerable extent. An important pollinating agent of the flowers of *Bombax malabaricum*, *Butea frondosa*, and *B. superba*, *Erythrina indica* and *E. suberosa*, and many other species from which it may invariably be seen sipping the nectar.

I remarked that the birds in the Western portions of the State (Kannad, Bhāmarvādi, Aurangābâd, etc.) also belonged to this race and were not the more rufous typical *somervillei* of Bombay.

On 16 October (Farāhābād) I came upon two young *Hierococcyx varius* among a sisterhood of these Babblers, clamouring to be fed, which one of the flock did from time to time. The cuckoos were already considerably larger than their foster-parents, and it was noteworthy that immediately one of these birds left its perch and flew across to another, a member of the sisterhood promptly gave the alarm as one hears on the approach of a hawk. It was clear from this that the other birds of the flock realised that the young cuckoos were not exactly of them, and even suspected them, nevertheless the mentality of the foster-parents seems curious that in spite of these repeated alarms from their brethren, they apparently failed to recognise that they had been duped, and continued to tend the hefty impostors!

Breeding:—No. 41 (6 October) had the testes ca. 8×5 mm. and was presumably breeding. No. 185 (29 October) was immature, with a soft skull. In No. 641 (3 April) the testes measured 11×7 mm.—breeding. No. 659 (6 April) was a juvenile just out of nest and able to fly with difficulty. Its skull was quite unossified. The rest of the specimens, all adult, had the organs in an undeveloped condition. From this it is clear that in Hyderābād State, as in other portions of its range, the bird has no well-defined breeding season.

A point frequently observed by me, and one that I have not seen mentioned elsewhere, is that breeding birds (pairs or incubating individuals) continue to remain with the flock during this period, only detaching themselves now and again to attend their private concerns. This I have found to hold good in the case of *T. striatus* also.

Turdoides striatus polioplocamus Oberholser. The White-headed Babbler.

Turdoides striatus polioplocamus Oberholser, Proc. Biol. Soc., Washington, xxxiii, 1920 (December), p. 84—Gingee [= *Crateropus griseus*, Fauna, ed. i.]

Specimens collected:—48 ♂ 7-10-31 Manānūr 2,000 ft.; 161 ♂ (juv) 18-10-31 Farāhābād 2,800 ft.; 291 ♂ (imm), 292 ♀ 11-11-31 Nelipāka 160 ft.

Elsewhere noted at: Singarenni Collieries, Borgampād, Pāloncha, Āsifābād, Hyderābād City and Environs, Mūkher, Utnoor.

Iris creamy white; bill, legs, feet and claws pale lemon; mouth pale yellow. In the young bird the iris is greenish-grey; bill pale flesh colour; mouth bright orange-yellow.

[Utnoor, Āsifābād and Mūkher slightly extend the known range towards the north-west.

I have not previously been able to examine a juvenile of this common species. It resembles the adult, but the streaking of the mantle and the squamation of the chin, throat and breast are very indistinct, these parts being pale and almost unicolorous.—H.W.]

This is the commonest Babbler in the gardens and environs of Hyderābād City. It is generally distributed in the eastern portions of the State, but is apparently absent to westward. None were seen at Kandahār, only a single flock of 7 or 8 at Mūkher, and thence again absent at Deglūr, Kaulās, Aurangābād, Kannad and Bhāmarvādi.

It haunts both dense and secondary jungle—being a frequent member of the localised forest associations—as well as scrub country in the vicinity of cultivation and human habitations. Its call is distinct and quite unmistakable with that of *T. s. malabaricus* being a sharp musical *trr-ri-ri-ri* uttered as the tail is spread and the bird nervously twitches its wings and pivots from side to side.

Commonly observed feeding on Gulair (*Ficus glomerata*) figs and berries of *Zizyphus œnoplia*, and like the Jungle Babbler it is invariably present on *Erythrina* and *Butea* flowers, whose pollen may often be seen adhering to the throat feathers.

Breeding:—No. 48 (7 October) had the testes enlarged to ca. 8×4 mm. and was probably breeding. No. 161 (18 October) had the skull unossified and it was just moulting out of juvenile plumage. No. 291 (11 November) was slightly older, with only a soft patch in the centre of its skull. In No. 292, apparently the mother of above, the organs had reverted to the normal condition. On 22 January three fully-fledged young were noted among a flock in a garden at Saifābād (Hyderābād City) whom the parents fed from time to time. On 8 February I observed a pair from this same flock collecting twigs and rootlets in a *Loranthus* clump on a Nim tree at about 14 ft., to which pieces of old newspaper were being added. The pair detached itself from the sisterhood and worked at the nest, chiefly in the early mornings. Lastly, on 12 April a nest was found (loose cup of rootlets etc.) in a stunted *Ficus* growing horizontally out of the fort ruins at Nirmal (Āsifābād District) containing three fresh eggs. While the owner was sitting on the nest, the rest of the sisterhood kept within call in the vicinity. The eggs, turquoise-green and well-glossed, measured 24×17, 23×18 and 24×19 mm. respectively.

From the above evidence it appears that there is no well-defined breeding season in the Hyderābād State, and that eggs are probably laid in most months of the year.

I might here repeat that in my experience of the Hyderābād State, wherever their distributions coincided, I frequently found this species and the Jungle Babbler living side by side, and at times indeed as members of the same localised forest association. I cannot therefore support the assertion made in the Eastern Ghats Report (J.B.N.H.S., xxxv, 740) that there is no association in life between the White-headed and Jungle Babblers.

Argya caudata caudata (Dumont). The Common Babbler.

Cossyphus caudatus Dumont, Dict. Sci. Nat., xxix (1823, December 27), p. 268—India.

Specimens collected:—2 ♀ 25-9-31 Hyderābād City Environs 1,800 ft.; 357 ♂ (imm) 23-11-31 Pāloncha 300 ft.; 457 ♂ (imm) 13-12-31, 475 ♀, 476 ♂ 16-12-31 Āsifābād 1,200 ft.; 606 ♀ (imm), 607 ♀ 24-3-32 Kaulās 1,350 ft.; 713 ♂ 18-4-32 Kannad 2,000 ft.

Elsewhere noted at: Kandahār, and along Jedcherlā-Achampēt Road (Mahbūbnagar District). Apparently absent on the Amrābād Plateau.

Iris brown or orange-yellow; bill fleshy-brown or brown with the base of the lower mandible yellow; mouth pale flesh colour; legs and feet yellow; claws horny brown.

In the young bird the gape and mouth are bright yellow.

[I have been able to supplement this series with 5 skins collected by Col. Sparrow at Trimulgherry and Pārtūr, which he was kind enough to lend me. Like the next species, the Common Babbler has evidently developed no races in India proper apart from the extreme north-west.—H.W.]

Distributed fairly generally throughout the Dominions in open scrub jungle and boulder-hillock country with sparse thorny bushes. It avoids actual forest but, as at Āsifābād and Pāloncha, haunts bush jungle in the neighbourhood of cultivation and on the fringe of forest.

These Babblers are particularly fond of hedges and patches of prickly scrub separating fields, where they scuttle about like rats through the undergrowth, uttering their pleasant trilly whistling calls. Flocks of 7 to 10 birds commonly seen.

Breeding:—No. 2 (25 September) had the ovarian follicles ca. 1 mm. in diameter, and they seemed to be developing. No. 357 (23 November) was immature with as yet two soft patches clearly discernible on the skull. No. 457 (13 December) was younger still, with the entire skull unossified. Both 475 and 476 (16 December) showed signs of the beginning of genital development. No. 606 (24 March) was like 457, while 713 (18 April) had the testes enlarged to 14×7 mm. and was obviously breeding, though still member of a flock.

In the case of this species also there appears to be no hard and fast breeding season within State limits. In the neighbourhood of Trimulgherry, Col. Sparrow found eggs from 2 March to 11 July. According to him, March is the best month for fresh eggs in that locality.

Argya malcolmi (Sykes). The Large Grey Babbler.

Timalia malcolmi Sykes, P.Z.S., 1832 (July 31), p. 88—Deccan [=Poona.].

Specimens collected:—87 ♀ (juv), 88 ♀ 11-10-31 Manānūr 2,000 ft.; 705 ♀ 17-4-32 Kannad 2,000 ft.

Elsewhere noted at: Hanamkonda (Warangal District), Kandahār, Mūkher, Aurangābād, Bhāmarvādi, Hyderābād City Environs (Himāyatsāgar and Mir Ālam Tanks).

Iris bright lemon-yellow; bill horny-brown, darker at gape and paler at base of lower mandible; mouth blackish-brown; legs and feet brownish-grey; claws dusky. In the juvenile, the mouth was bright lemon-yellow.

[Has no races.—H.W.]

The Large Grey Babbler appears to be much more common and generally distributed in the western portions of the State (Mahrattwāda) than in the eastern (Telingāna). Indeed, with the exception of a single flock seen at Hanamkonda (Warangal District) I did not meet it at all at Borgampād, Nelipāka, Pāloncha, Narsampēt, Āsifābād or Utnoor. At Manānūr, on the Amrābād Plateau, where two of the specimens were procured, it was also far from common. In the Nānder and Aurangābād Districts it is certainly the commonest Babbler, haunting open Babūl forest and cultivation or sparsely shrubbed country, interspersed with Mango and Nim trees.

Breeding:—No. 87 (11 October) was a young bird with soft skull and loose untidy juvenile plumage. No. 88 from the same flock had undeveloped ovaries, while some of the follicles in No. 705 (17 April) were over 1 mm. in diameter and appeared to be enlarging. As in the other Babblers, the breeding season within this area seems undefined.

Pomatorhinus horsfieldii Sykes. The Deccan Scimitar-Babbler.

Pomatorhinus horsfieldii Sykes, P.Z.S. 1832 (July 31), p. 89—'Dense Woods of the Ghats' [=Mahableshwar].

Specimens collected:—136 ♀ 16-10-31, 147 ♀, 148 ♂ 17-10-31 Farāhābād 2,800 ft.

Elsewhere not noted.

Iris reddish-brown; bill orange-yellow, a variable area dark brown; mouth pink; legs and feet dusky plumbeous; soles lemon yellow.

[In the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, p. 741) I dealt in some detail with subspecific variation of this Scimitar Babbler and expressed the hope that material procured by the Hyderābād Survey might clarify the situation. It has certainly helped to some extent. The bird was only met with on the Amrābād Plateau, which is physically little but a continuation of the Nallāmalāis. The three specimens obtained agree in size and colour with the birds obtained by the Eastern Ghats Survey in the south-eastern ghats. It therefore appears probable that this short-billed olive-brown form without a black edge to the plastron is cut off by a break in distribution from either *travancoreensis* or *horsfieldii* or the long-billed bird of the Vizagāpatūm ghats. If this is in future confirmed, I am of opinion that the race should be recognised and named.—H.W.]

Curiously enough, the Scimitar Babbler was only met with at Manānūr and Farāhābad on the Amrābād Plateau, and nowhere else within the State. They were partial to Bamboo jungle, moving about in parties of 4 or 5, or pairs—more commonly the latter—and were extremely shy. In the case of pairs the male acts as leader and is followed about from one clump or tree to another by the hen who acknowledges by a subdued *kroo-kroo* or *krokānt* (accent on second syllable) every one of his musical whistling calls. The birds were sometimes observed descending to the ground, hopping about and flicking over dry leaves like *Turdoides*, or clinging to the side of a mud-bank or cutting and digging vigorously for insects.

Breeding:—In the ♂, No. 148 (17 October), the testes were ca. 3×2 mm. but the ovaries in both the ♀♀ showed no signs of development.

Dumetia hyperythra hyperythra (Franklin). The Rufous-bellied Babbler.

Timalia hyperythra, Franklin, P.Z.S., 1831 (October 25), p. 118—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mundela.

Specimens collected:—180 ? (imm) 20-10-31 Farāhābād 2,800 ft.; 241 ♀ (imm) 4-11-31, 255 ♀ (imm) 6-11-31 Borgampād 160 ft.; 300 ♂ 13-11-31, 315 ? (imm) 316 ♀, 317 ? (imm) 15-11-31 Nelipāka 160 ft.; 360 ♂, 361 ? (imm) 23-11-31 Pâloncha 300 ft.; 403 ♂ 1-12-31 Narsampēt 800 ft.; 601 ♂ 23-3-32 Kaulās 1,350 ft.; 678 ♂ 8-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Nekōnda (Warangal district), Pākhāl Lake, Āsifābād.

Iris hazel brown; bill pale horny-brown, darker on upper mandible; mouth pale fleshy pink; legs and feet pale yellowish. In the young bird the mouth is tinged with yellow, the iris paler and the legs more brownish-fleshy.

[The above series was supplemented by the loan of 5 specimens from Mulkāram and Eswantarāopet from Colonel Sparrow. Nos. 403, 601, 678 as well as Col. Sparrow's birds are typical *hyperythra*. The others agree well with them, but show a slight passage to the intermediate birds which were obtained by the Eastern Ghats Survey in the Nallāmalāi range, a further proof if more were needed that *hyperythra* and *albogularis* should be treated as races of one species.

The juvenile plumage may be recognised by the broad, soft round-tipped first primary and the soft narrow tail feathers. The post-juvenal moult is complete and remarkable evidently for the very sudden casting of the tail feathers, as in the case of *Copsychus saularis*.—H.W.].

The Rufous-bellied Babbler was rare on the Amrābād Plateau where only a single family party of 4 or 5 was met with at Farāhābād among tall grass interspersed with thorn bushes. It was fairly generally distributed elsewhere (where not replaced by *albogularis*), affecting hedges and thorny scrub country. This little Babbler goes about in flocks of from 4 to 8 birds and like *albogularis*—from which I found its voice and habits indistinguishable—keeps up a low *cheep-cheep* (sometimes mistakable for *Leptocoma*) varied by harsh tittering notes. It is an inveterate skulker. On taking alarm the party promptly dives into the thickest portions of the undergrowth and disperses in all directions, but soon reassembles by the louder and more agitated *cheep*'s and tittering of its members.

Kaulās was the most westerly camp at which this race was noted. At Kannad its place had been taken by *albogularis*. The only occasion when I had a real suspicion of the ranges of the two races overlapping was at Kaulās where a party was seen in thick cover whose underparts appeared distinctly paler than those of the birds I had met all along heretofore. Unfortunately a specimen could not be secured.

Breeding:—No. 180 (20 October), 315 and 317 (15 November) and 361 (23 November) all had the skulls either wholly soft or in varying degrees of ossification. A ♂, No. 403 (1 December), still had the testes ca. 3×2 mm. but they were pulpy in texture suggesting that he had finished breeding. In the rest of the specimens the gonads were undeveloped. From the above it would appear that the breeding season is in the latter part of the monsoon.

Col. Sparrow, who found this bird very common in the Eswantarāopet jungles near Secunderabād and also near the Hyderābād Residency, obtained eggs between 22 June and 31 August. He considers July to mid-August as the best time for fresh eggs.

Dumetia hyperythra albogularis (Blyth). The White-throated Babbler.

Malacocercus (?) *albogularis* Blyth, J.A.S.B., xvi, 1847 (after May), p. 453—Taipoor Pass and near Jaulnah. (=Jālna, north-west Hyderābād State).

Specimen collected:—729 ♂ 21-4-32 Bhāmārvādi 2,500 ft.

Elsewhere not noted.

Colours of soft parts as in *hyperythra*.

Only once met with. A flock of about 8 birds skulking in grass and thorny undergrowth on a hillside near Outram Ghāt.

Testes of specimen undeveloped.

Chrysomma sinensis sinensis (Gmelin). The Yellow-eyed Babbler.

Parus sinensis Gmelin, Syst. Nat., vol. i, pt ii (1789), p. 1012—China.

Specimens collected:—6 ♂ 25-9-31 Hyderābād City Environs 1,800 ft.; 91 ♂, 92-95 (juv) 11-10-31, 125 ♂ 14-10-31 Manānūr 2,000 ft.; 209 ♀ (imm), 210 ♂ (imm) 1-11-31 Borgampād 160 ft.; 345 ? (imm) 20-11-31, 352 ? 21-11-31 Pāloncha 300 ft.; 413 ♂ 3-12-31 Narsampēt 800 ft.; 469 ♀ (imm) 14-12-31 Āsifābād 1,200 ft.; 573 ♂ 19-3-32, 599 ♂ 23-3-32 Kaulās 1,400 ft.

Elsewhere noted at: Singarenni Collieries, Nelipāka, Nekōnda (Warangal District), Kandahār, Utnoor and Nirmal.

Iris orange-yellow; eyerim orange; bill black; legs and feet bright chrome-yellow or brownish lemon-yellow; claws dusky. The mouth apparently differs seasonally, black in the breeding season, otherwise orange-brown.

In the nestlings the iris is greenish-brown; bill pale horny-brown; gape lemon-yellow; mouth bright chrome-yellow; legs and feet pinkish flesh colour; tibio-tarsal joint bright yellow.

In immature birds, about the time of the post-juvenal moult, the bill is horny-brown; gape black; nostril area yellow, and the yellow gradually fades out of the mouth.

The juvenile plumage is very similar to worn adult plumage, but the wings are a paler chestnut. The post-juvenal moult is complete.

[As remarked in the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, p. 745) it is exceedingly doubtful whether the Indian Peninsula bird is really the typical form, but until more material is forthcoming from China the point cannot be proved.—H.W.]

Generally distributed throughout the State in suitable localities which consist of tall grass-and-scrub country and hedges etc., on the fringe of cultivation. I did not meet with this species in the north-western corner, at Aurangābād, Kannad or Bhāmarvādi.

Breeding:—On 11 October (Manānūr) a nest was found hung hammockwise between the stems of some monsoon weeds (at about 18 in. from the ground) in a small open patch in scrub jungle. The nest, a deep cup of rootlets etc. bound and plastered with cobwebs, contained specimens 92-95 huddled together in it. They were just old enough to flutter out when handled. From the gonads of numerous specimens examined, and the fact that a large proportion of those collected between October and December were immature with skulls in varying stages of ossification, it is evident that the breeding season is in the latter part of the monsoon.

Col. Sparrow obained eggs from 2 July to 22 September in the scrub-and-grass country near Trimulgherry and in the Eswantarāopet jungles where this Babbler was very common. He considers August to be the best time for fresh eggs.

The stomachs of the nestlings (Nos. 92-95) contained green caterpillars and soft portions of grasshoppers.

Both parents share in the feeding of the young and also in incubation as evidenced by No. 91 which was busy feeding the above nestlings, and by No. 413 which has a conspicuous incubation patch present.

The males continue to sing from exposed perches although in heavy post-nuptial moult.

Pellorneum ruficeps ruficeps Swainson. The Spotted Babbler.

Pellorneum ruficeps Swainson, Fauna Boreal. Amer., 1832 (February), p. 487—India.

Specimens collected:—319 ♂ 15-11-31 Nelipāka 160 ft.; 358 ♂ 23-11-31 Pāloncha 300 ft.

Elsewhere noted at: Pākhāl Lake.

Iris orange-brown; bill pale flesh colour, horny-brown above; mouth pale brownish and lemon-yellow; legs, feet and claws yellowish flesh colour.

Besides the localities named above, the Spotted Babbler was not met with although in many places the country appeared eminently suitable. The birds were very shy, and on the whole, silent, though where occurring they were invariably heard singing in the early mornings and at dusk. They kept to heavy scrub and secondary jungle, rummaging among dry leaves on the ground, either in pairs or small family parties of 3 or 4. The members keep in touch with one another by a subdued musical *weet* repeated at intervals of half a second or more. They also have a pretty call of 3 or 4 rich, mellow whistling notes not unlike (and indeed sometimes easily mistakable for) those of an Iora-*whi-whi-whee* ('He'll beat you' or 'He will beat you', occasionally varied by merely 'He'll beat'), ascending in scale. This is often repeated every two seconds or so for quite ten minutes or more at a time. The other of the pair (♀?) who is invariably near at hand, answers in very Iora-like notes ('Its all-right'). These replies, however, do not necessarily persist *all* the time the ♂ (?) is calling.

The song, uttered from a perch, is a loud and pretty whistle of many rambling notes, and is often prolonged for five minutes or more at a time.

Breeding:—The testes of my specimens were in an undeveloped condition and both the birds were in heavy post-nuptial moult. The family parties were observed to contain full-fledged young. As in the Konkan therefore, they appear to breed in the latter part of the monsoon, which incidentally is much later than in other parts of their range (March to June).

The suggestion on p. 239 of Vol. i of the *New Fauna* that this bird apparently does not breed below 2,000 ft. is certainly untenable. I have commonly found it breeding at Kihim (Kolāba District, Bombay Presidency) at practically sea-level, and there is good reason to believe that it also does so at Nelipāka 160 ft. and Pāloncha ca. 300 ft.

Aegithina tiphia humei Stuart Baker. The Central Indian Iora.

Ægithina tiphia humei Stuart Baker, Fauna B.I., Birds (2nd. ed.), vol. i, July 1922 (=August 16, 1922), p. 342—Raipur, Central Provinces.

Specimens collected:—126 ♀ (imm) 14-10-31 Manānūr 2,000 ft.; 240 ? (imm) 4-11-31, 257 ♀ 6-11-31 Borgampād 160 ft.; 287 ♂ 11-11-31 Nelipāka 160 ft.; 448 ♂, 449 ♀ 8-12-31 Narsampēt 800 ft.; 577 ♂ 19-3-32 Kaulās 1,350 ft.; 698 ♂ 16-4-32 Kannad 2,000 ft.; 742 ♀ 24-4-32 Bhāmarvādi 2,500 ft.

Iris buff, greenish-buff, greyish-brown or silvery-fawn colour; bill bluish-grey, black on culmen; mouth brown or blackish; feet slaty-blue; claws dusky.

Generally distributed and common throughout the Dominions. Partial to secondary jungle, gardens and groves, specially Mango, Nim and Tamarind. Even ♂♂ in non-breeding plumage indulge in their aerial displays, rising a few feet in the air and returning to the perch fluttering, with tail depressed and white rump feathers fluffed out. No. 448, an ad. ♂, although in fresh winter plumage (testes undeveloped) was assiduously courting No. 449 (ovaries undev.), flicking his wings, craning forward to bring his bill close to the hen's, and uttering a long-drawn musical *chee-ee*. The hen on the whole remained supremely indifferent to his advances, merely snapping playfully at his bill from time to time. The whistling calls of the cock are invariably responded to by the hen hunting among the foliage hard by.

Breeding:—On 25 September a nest with three eggs was found in a garden at Saifābād (Hyderābād City). Both parents were observed brooding in turns. No. 126 (14 October) and 240 (4 November) were immature birds with soft skulls, and the gonads and moults of the others suggested that breeding was over. From the evidence I have, it would appear that the latter part of the monsoon (August, September) is probably the most favoured for breeding in this area. It is possible that it breeds earlier in the year also since No. 698 ♂ (16 April) was in full breeding plumage and had testes measuring ca. 4×2 mm.

Col. Sparrow found the Iora very common in and around Trimulgherry and also in the Eswantarāopēt jungles, where he took eggs from 6 April to 11 September. He considers July and August the best months for fresh eggs. On 20 July, he found three nests with young.

Chloropsis jerdoni (Blyth). Jerdon's Chloropsis.

Phyllornis jerdoni Blyth, *J.A.S.B.*, xiii, 1844 (after December), p. 392—Goomsoor.

Specimens collected:—37 ♀ 6-10-31, 60 ♂ 8-10-31 Manānūr 2,000 ft.; 587 ? 21-3-32 Kaulās 1,350 ft.

Iris brown; bill ♂ horny black; ♀ horny-brown, bluish-grey at base and basal half of lower mandible; mouth leaden pink. Legs and feet ♂ pale bluish-slate, ♀ greyish plumbeous; claws dusky.

Jerdon's Chloropsis appears to be somewhat patchily distributed in the Hyderābād State, being confined to the more forested and hilly portions. I did not meet it at Kandahār, Mūkhēr, Deglūr, Aurangābād or Kannad. It was commonest at Farāhābād on the Amrābād Plateau, though even here by no means plentiful, and rather rare elsewhere.

The birds go about in pairs and were frequently noted as members of the localised forest associations. It is an accomplished mimic, among others imitating both *Dicrurus macrocercus* and *D. cœrulescens* to perfection. One near the Farāhābād Forest Bungalow was timed for over 40 minutes at this mimicking game, during which it imitated in rapid succession the two Drongos, *Molpastes cafer*, *Orthotomus sutorius*, *Dendrocitta vagabunda* and *Turdoides striatus*, while some of the harsh vulgar squeals of *Lanius caniceps* were also reproduced. On another occasion I was taken in by its very colourable imitation of *Graucalus macei* and the Striped Squirrel (*Funambulus*). Its own call of several notes is distinct, and is occasionally wedged in between the mimicry.

Breeding:—All three specimens were adult, but their breeding organs—of the two sexed—were in a quiescent state.

In the Eastern Ghats Report (*J.B.N.H.S.*, xxxv, p. 752) it is stated that Col. Sparrow found *Chloropsis aurifrons insularis* breeding about Eswantarāopet near Secunderābād from the end of June to the middle of August, but that most eggs were obtained in early July. On enquiry, Mr. Whistler informs me that Col. Sparrow's collection contained no specimen of *aurifrons* from any part of Hyderābād and that in his breeding notes for this area he does not give *jerdoni* at all! As I myself failed to come across *aurifrons* in any of the localities surveyed it is clear that Col. Sparrow has been under a misapprehension and that his information as regards nesting really relates to *jerdoni*.

FAMILY: PYCNONOTIDÆ.

Molpastes cafer cafer (Linnæus). The Red-vented Bulbul.

Turdus cafer Linnæus, Syst. Nat., xii ed., vol. i (1766), p. 295—Cape of Good Hope, (*errore*), Ceylon.

Specimens collected:—105 ♂ 12-10-31 Manānūr 2,000 ft.; 186 ♂? 29-10-31 Borgampād 160 ft.; 456 ♀ 12-12-31 Āsifābād 1,200 ft.; 525 ♀ 8-3-32 Mūkhēr 1,350 ft.; 714 ♀ 18-4-32 Kannad 2,000 ft.

Iris dark brown; bill black; legs and feet brownish-black; mouth orange-yellow in No. 105, a mixture of grey, yellow and pink in the others.

[Definitely of this race in plumage though slightly larger than individuals from the extreme south as they approach the range of *pallidus*.—H.W.]

The Red-vented Bulbul is widely distributed and exceedingly common throughout the State, being in many localities the commonest bird on the countryside. It inhabits sparse secondary jungle, scrub country and gardens, both near and away from human habitations, and avoids the more densely forested tracts. This species is largely responsible for the seed dispersal of a great many plants in Hyderābād, the commonest being *Zizyphus œnoplia*, and the various kinds of *Ficus* that fruit in such profusion everywhere. It is also an important pollinating agent of many flowers such as *Bombax*, *Erythrina* and *Butea*, while on occasion I have observed it probing into the tubular scarlet flowers of *Woodfordia fruticosa*.

Bulbuls were much prized as fighting birds in Hyderābād a few years ago, before the law prohibiting animal fights came into force. It was then a familiar sight to see the sporting 'bloods' sauntering about the bazaars with their birds, secured by a string brace, perched on a finger and being made much of. Large sums were wagered on those bouts and victorious birds fetched big prices.

Breeding:—On 12 May (1927) I found a nest at Saifābād (Hyderābād City) containing two young, about 10 days old. On 28 May (1928) Mrs. Tasker had a nest in a clipped *Bougainvillea* shrub in her garden at Begampēt (Hyderābād City Environs) containing 1 egg. On 13 October (1931) I observed a full-fledged young at Manānūr being fed by its parents. The ovarian follicles of No. 714 (16 April, Kannad) clearly showed signs of enlarging. I believe in the Hyderābād State also—as in the Konkan and elsewhere—the breeding season is much prolonged, ranging between April and September.

Otocompsa jocosa emeria (Linn.). The Red-whiskered Bulbul.

Motacilla emeria Linnæus, Syst. Nat., x ed. (1758), vol. i, p. 187—Bengal.

Specimen collected:—242 ♂ 4-11-31 Borgampād 160 ft.

Iris brown; bill dark horny-brown; mouth lemon-yellow and pink; legs, feet and claws dark horny-brown.

[Mr. D'Abreu has kindly let me see a female of this race, one of a pair, obtained by him at Nāgpūr on 7-4-1932.—H.W.]

Only seen twice within State limits: a pair in riverain jungle on the bank of the Kinarsāni River near Borgampād (specimen), and another pair on 23 November in scrub jungle at Pāloncha. Absent elsewhere.

The organs of the specimen were in an undeveloped condition.

Pycnonotus luteolus luteolus (Lesson). The White-browed Bulbul.

Hæmatornis luteolus Lesson, Revue Zool., December 1840 (January 1841) p. 354—India, Bombay.

Specimens collected:—68 ♀ 9-10-31, 111 ? 13-10-31 Manānūr 2,000 ft.; 289 ♂ 11-11-31 Nelipāka 160 ft.

Iris reddish-brown; bill horny-black; legs, feet and claws horny-brown; mouth yellowish-pink (No. 68), pinkish grey (No. 111), bright yellow (No. 289). Bill of 111, in post-juvenal moult, dark horny-brown; legs and feet dark slate colour.

The White-browed Bulbul is a common garden bird in Hyderābād City and environs. It is fairly generally distributed in the State, though I have no record of it from Aurangābād, Kannad or Bhāmarvādi while at Kandahār Mūkhēr and Deglūr it was definitely noted as absent. At Kaulās it was uncommon. The birds were usually met with in pairs, affecting scrub jungle and bush country on the fringe of forest clearings. Along with other species, it was observed to feed largely on the small round black drupes of *Zizyphus œnoplia*, so abundant everywhere, and it doubtless plays an important part in the dissemination of its seed.

The organs of No. 68 and No. 289, both adult, were in a quiescent state.

No *Microscelis p. ganeesa* was met in Hyderābād in spite of the range given in the *New Fauna* as from Mātheran southwards.

FAMILY: CERTHIDÆ.

Salpornis spilonotus spilonotus (Franklin). The Spotted Grey Creeper.

Certhia spilonota Franklin, P.Z.S., 1830-31 (1831, Oct. 25), p. 121—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Guru Mundela.

Specimens collected:—739 ♂, 740 ♀ 22-4-32 Bhāmarvādi 2,500 ft.

Iris brown; bill, upper mandible and commissure of l.m. horny-brown, remainder of lower mandible flesh colour; legs and feet greyish-brown; claws brown.

The above was the only pair met with in the Hyderābād State—in fairly open deciduous forest.

Breeding:—Shot off nest containing 2 eggs. Both parents share in incubation; the ♀ who was on the nest was relieved by the ♂ while I was watching.

The testes of the ♂ measured ca. 5×3 mm.; the follicles of the ♀ 1-1.5 mm. The nest, a deep cup, was fixed in a crotch of a black- and rough-barked leafless *Acacia* sapling at a height of about 10 ft. Its exterior was composed entirely of cobwebs, caterpillar droppings, vegetable down and spiders' egg cases. It was blackish in colour and perfectly camouflaged among the built-in supporting branches. Inside diameter of cup 45 mm., thickness of wall 12 mm., inside depth of cup 45 mm. It was lined with soft spiders' egg-bags and some dry *Acacia* leaflets which may possibly have dropped in accidentally.

The eggs, slightly set, measured 19.5×13 and 19×13 mm. respectively. Pale greenish-grey with dark brown specks and paler phantom blotches, specially on the broad end.

FAMILY: TURDIDÆ.

Saxicola caprata bicolor. Sykes. The Northern Indian Stone-Chat.

Saxicola bicolor Sykes P.Z.S., 1832 (July 31), p. 92—Dukhun.

Saxicola caprata burmanica Stuart Baker. The Burmese Stone-Chat.

Saxicola caprata burmanica Stuart Baker, Bull. B.O.C., xliii (1923), p. 19—Pegu.

Specimens collected: 84 ♂, 85 ♂, 86 ♀ 11.10.31 Manānūr 2,000 ft.; 196 ♀ (imm.) 30.10.31, 256 ♂ 6.11.31 Borgampād 160 ft.; 461 ♂ 13.12.31 Āsifābād 1,200 ft.; 513 ♂ 5.3.32 Kandahār 1,400 ft.; 689 ♂ 9.4.32 Utnoor 1,250 ft.

Iris dark brown; bill ♂ black, base of lower mandible brownish, ♀ dark brown; mouth pale pink; legs, feet and claws black.

[It is interesting to note, and it incidentally illustrates the value of the recognition of subspecies, that I had already satisfied myself from the examination of the specimens sent (before Mr. Ali's notes arrived) that two races of the Pied Stone-Chat occur in the Dominions.

Nos. 461 and 513 most clearly belong to the north-western race *bicolor* which is evidently a common winter visitor to the Dominion, and this is confirmed by the fact that No. 513 was extremely fat, evidently in preparation for migration, at a time when the resident form was ready to breed. It also explains how the Deccan can be the type locality for Sykes' name.

The other birds all belong to the small-billed form with very little white on the underparts which was obtained by the Eastern Ghats Survey and which I have already shown to be identical with *S.c. burmanica* of Stuart Baker. This name is as a matter of fact probably antedated by *Motacilla sylvatica* Tickell, *J.A.S.B.*, 1833, p. 575—Bhorabhum and Dholbum, but I have not yet been able to examine specimens from that area to confirm this identification.

Some form of Pied Bush-Chat breeds very commonly along the Sahyadris and it is desirable to obtain series to show what this race is.—H.W.]

The Pied Stone-Chat, or Bush-Chat as it is sometimes called, was not observed at Aurangābād, Kannad or Bhāmarvādi, but was otherwise found generally distributed throughout the Dominions. I believe in the cold weather there is a great influx of birds from the N.-W. On 11 October (1931) I have the following note in my diary: 'Appear to have increased markedly during the past two or three days. For one single specimen seen in the village precincts previously, there were at least six males in evidence this morning. Some of the males are still in song uttering this from roof-tops and other exposed situations'. The increase continued and was noted on subsequent days also. The birds are as a rule tame and confiding and frequent the neighbourhood of cultivation and villages, where they are commonly seen perched on stones, fences, etc. They appear to have a particular attraction for hedges of the Century Plant (*Agave*).

Breeding: No. 196 (30 October) was an immature bird with soft skull, evidently of a late brood. At the middle of March I noted males singing vociferously from roof-tops, etc. at Deglūr. There were no hens in evidence, and from the frequent chasing off of other intruding males it appeared as though they were establishing breeding territories. As an alternative, however, it may be that the hens were already on eggs.

The song begins with a double *chick-chick*, and is in many respects similar to that of *Saxicoloides* or of *Melophus*. The singing bird occasionally takes short ludicrous jumps into the air, and returns to its perch. It sometimes indulges in a song-flight, describing an aerial arc, flapping its wings deliberately over its back, like a pigeon 'clapping'. On 27 March at Kaulās, males were in full song on every side. A nest was discovered in a crevice of the ruined fort wall. It was a shallow pad of soft grasses with a depression in the centre, sparsely lined with hair and seed-down. It contained three fresh eggs of a pale sea-green ground colour, with brownish-red specks and blotches, chiefly at the broad end. They measured: 19×15 mm. (1), 19×14 mm. (2).

On 28 March (Kāmāreddi Railway Station) a nest was located in the side of a dry depression in a field. Specimen No. 689 (9 April) had the testes enlarged to 10×7 mm. and obviously had its mate on a nest in the vicinity. On 11 April (Itchora, Āsifābād District) a nest was found, just completed, in a niche in the side of hollow ground, close to the Dâk Bungalow. On 12 April (Nirmal) a male was observed carrying food to young, and on 29 April (Hyderābād City) a pair were breeding in a hole in a pucca-built well.

In the examples not mentioned above, the gonads were in an undeveloped condition.

The evidence clearly indicates that the breeding season proper extends from March to June.

Col. Sparrow found it breeding very commonly near Trimulgherry where he obtained eggs between 23 March and 23 June.

All the breeding (resident) birds certainly belonged to a very black race closely resembling *atrata* having only a very little white on the vent.

Saxicola torquata indica (Blyth). The Indian Bush-Chat.

Pratincola indica Blyth, *J.A.S.B.*, xvi (1847), p. 129—India, Calcutta.

Specimens collected:—121 ♀ 13-10-31 Manānūr 2,000 ft.; 278 ♂ 9-11-31 Nelipāka 160 ft.; 384 ♂ 27-11-31 Pāloncha 300 ft.; 409 ♀? 2-12-31 Narsampēt 800 ft.; 515 ?, 516 ♀ 7-3-32 Mūkhēr 1,350 ft.

Iris brown; bill, legs, feet and claws black; mouth pink, yellowish-pink or pinkish-slate.

[It is not generally known that in this race of Bush-Chat the first-winter ♂ may be found in two states of plumage and as there is no Spring moult it is also to be found breeding in them:—(*a*) Quite indistinguishable from the female though tending to be slightly darker in tint throughout, (*b*) Similar to the adult male except that the primary-coverts, primaries and secondaries and narrow tail feathers of the juvenile plumage are retained; the fringes on the black of the ear-coverts, chin and throat are wider and paler at first, before wear, almost obscuring the characteristic male colouration.

The adult and first-year ♀♀ cannot with certainty be distinguished except when the narrow juvenile tail feathers are recognisable as such.—H.W.]

The earliest date on which I encountered the Indian Bush-Chat was 3 October (between Jedcherla Railway Station and Achampēt, on the road to Manānūr). It is possible they may have come in earlier, but in the environs of Hyderābād City at any rate none were to be seen between 20 September and the above date. After 17 March (Deglūr) I did not meet it anywhere.

Although generally distributed in the State during the cold weather, being present in pairs or singly on hedges and in the neighbourhood of jowari fields, fallow land, etc., it was not really abundant anywhere. Mūkhēr is the only place at which I have noted it as common.

The gonads of all my specimens, of course, were in an undeveloped condition.

Oenanthe deserti atrogularis. (Blyth). The Wheatear.

Saxicola atrogularis Blyth, *J.A.S.B.*, 1847, p. 131—Upper Provinces.

I find a note in my diary of 1925 that several Wheatears were observed along the route from Nirmal to Utnoor (via Talāmadri village) between 12 and 15 October. I did not, however, come across this bird anywhere within the State in the course of the present Survey.

According to its distribution as given in the *New Fauna* (Vol. ii, p. 52) its occurrence in the Deccan would seem improbable. However, a specimen was procured by me in Salsette (Pāli Hill, Bandra) on 27-2-24 and there are two others in the Society's Collection obtained by Mr. N. B. Kinnear at Santa Cruz, not far from the above, on 12-11-12 and 14-1-13 respectively. It is obvious that the *Fauna* 'distribution' stands in need of correction.

Phoenicurus ochrurus rufiventris. (Vieill.) The Redstart.

Œnanthe rufiventris Vieill. *Nouv. Dict. D'Hist. Nat.*, Nouv. ed. xxi (1818), p. 431—Bengal.

Specimens collected:—82 ♂ (imm) 10-10-31, 103 ♂ 12-10-31 Manānūr 2,000 ft.; 252 ♂ (imm) 5-11-31 Borgampād 160 ft.; 301 ♂ 13-11-31, 313 ♂ 14-11-31 Nelipāka 160 ft.; 398 ♀ 1-12-31 Narsampēt 800 ft.

Iris brown; bill horny-brown or blackish-brown; gape and mouth yellow; legs, feet and claws horny-brown or brownish-black; soles yellow.

[These examples all appear to me to be this race which is recognisable from *P. o. phœnicuroides* by its slightly larger size, and by the smaller proportion of grey fringing to the upper plumage, especially on the crown. The ♀ is rather darker both above and below. In the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, p. 70) I have written a note on the respective distributions of these two forms in India.—H.W.]

The earliest record I have of this species is 25 September, from the boulder-and-scrub country in the neighbourhood of Mir Ālam Tank (Hyderābād City Environs). I am informed by an old resident that Redstarts make their appearance invariably on the 23rd. of September each year! Last seen: 1 April (Utnoor).

Generally distributed in the State in the cold weather, being commoner in some localities than in others. It haunts gardens, village precincts, open stony country, and the boulder hillocks which are such a feature of many parts of the Deccan. In this last environment its colour harmonizes so perfectly with the basalt rock as often to render the bird quite inconspicuous even at close range.

On 12 October (Manānūr) my diary notes Redstarts as having been on the increase during the past 2 or 3 days. On 5 November (Borgampād) there was a large preponderance of males over females, and they were extremely shy.

No Redstarts were observed at Kaulās between 21 and 28 March and in the first ten days of April only a single bird (the last) was noted at Utnoor (1 April). From the fact that this species was common at Āsifābād (only ca. 35 miles to the east of Utnoor, and similar country) between 10 and 20 December, I conclude that the majority had migrated northward by the end of March.

Nos. 82 (10 October) and 252 (5 November) were young birds with imperfectly ossified skulls. The gonads of all the specimens were in an undeveloped condition.

Cyanosylvia svecica subsp? The Bluethroat.

Motacilla svecica Linn., Syst. Nat., x ed., vol. i (1758), p. 187—Sweden.

Specimens collected:—191 ? 30-10-31 Borgampād 160 ft.; 402 ♀ (imm) 1-12-31 410 ♀? (imm), 411 ♀ (imm) 2-12-31 Narsampēt 800 ft.; 455 ♂ 12-12-31 Āsifābād 1,200 ft.; 488 ♀? 1-3-32 Kandahar 1,400 ft.; 544 ♂ 14-3-32, 553 ? 15-3-32 Deglūr 1,300 ft.

Iris dark brown; bill horny-brown; gape yellow; mouth bright lemon-yellow; legs, feet and claws horny-brown, soles yellow. Hinder aspect of tarsus sometimes yellow.

[Three skins kindly lent to me by Col. Sparrow from Khārkeli, Trimulgherry and Chintakani evidently all belong to the same form as this series. These birds may perhaps belong to the race *pallidogularis* though the apex of the wing, which ranges from 16·5 to 21 mm. seems rather too long for it. In the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, p. 71) I have already explained that it is hardly possible to be sure of the racial identification of Bluethroats obtained in India in winter, because at present we are unable to be satisfied as to which of the many new races described from Northern and Central Asia by the Russians are valid, and also whether they can be separated in winter plumage, even if recognisable in the breeding areas.——H.W.]

First met 30 October (Borgampād); last 15 March (Deglūr).

Bluethroats were noted as common in the Tamarisk beds (*Phyllanthus Lawii*) on mudbanks in the Godāvari River at Nelipāka, and generally distributed in suitable country such as swampy paddy fields, grass and reeds on the fringe of tanks, and on moist ground with Babul or any kind of undergrowth. At Āsifābād it was also frequently met in straggly abandoned cotton fields and hedges, on ground not necessarily damp.

No. 402 (1 December) was still quite young with soft skull, while Nos. 410 and 411 (2 December) were somewhat older, having the unossified portion confined as a patch to the centre of the skull. Nos. 488 (1 March), 544 and 553 (14 and 15 March) were all extremely fat, suggesting that they were preparing to emigrate. In none of the specimens did the gonads show a departure from the normal (undeveloped) condition.

Saxicoloides fulicata intermedia. Whistler and Kinnear. The Indian Robin.

Saxicoloides fulicata intermedia Whistler and Kinnear, *J.B.N.H.S.*, xxxvi, p. 73 (15 November, 1932)—Rahuri, Ahmednagar.

Specimens collected:—133 ♂ 14-10-31 Manānūr 2,000 ft.; 271 ♂ 9-11-31, 288 ♂ 11-11-31 Nelipāka 160 ft.; 477 ♂ 16-12-31 Āsifābād 1,200 ft.; 632 ♂, 633 ♀ 2-4-32 Utnoor 1,250 ft.; 744 ♀ 24-4-32 Bhāmarvādi 2,500 ft.

Iris brown; bill horny-black; mouth brownish-pink; legs, feet and claws dark horny-brown.

[The series obtained, agreeing with seven specimens from Trimulgherry and Dichpalli kindly lent to me by Col. Sparrow, and three from Aurangābād in Col. H. R. Baker's collection, all belong to the intermediate form long recognised as existing in the centre of the Peninsula. The ♂ has the black back and crown heavily washed with brown, but this brown is not the grey-brown of the N.-W. Indian form *cambaiensis*, but far darker and more chocolate in tint. The ♀ is dark agreeing with the ♀ of the South-Indian *fulicata*. As I have already pointed out in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, p. 73) this so-called intermediate is a perfectly recognisable race with a definite distribution and herefore worthy of subspecific recognition.—H.W.]

The Indian Robin is exceedingly common throughout the State, affecting gardens, groves, village precincts, boulder and cactus country and cultivation, as well as deciduous forest. It is tame and confiding everywhere. At Nelipāka a ♀ regularly used to enter the shed where we were encamped and hop about the floor in among boots and other paraphernalia calmly searching for insects within a few inches of our feet! No. 271 was killed by a villager with a stick whilst perched on a fence.

Breeding:—The breeding season in this area is between February and May, the principal months being March and April. Between 25 March and 25 April eight nests were found with either eggs or chicks: Kaulās 1, Utnoor 3, Nirmal 1, Bhāmarvādi 3. Two or three eggs or young seemed to be the rule. The nests were situated in holes in buildings, hollow tree stumps, niches in earth cuttings, and in one case on the ground at the base of a tussock of grass in sparse scrub country. On a nest containing two eggs under a rafter of the Utnoor Dâk Bungalow, I observed that the ♀ brooded only at night leaving the nest unattended by day. The mid-day temperature then was ca. 100°F. in the shade and immediately under the tiles must be considerably higher. An almost full-fledged young at Nirmal (nest in ruined wall) feigned death when touched, in a very convincing manner, closing its eyes, extending its neck and maintaining its limpness when handled! In 632 and 633 (2 April) the organs were enlarged to breeding size. No. 744 (24 April) had apparently finished laying. In the rest of the specimens, the gonads were undeveloped.

Copsychus saularis saularis. Linnæus. The Magpie Robin.

Gracula saularis Linn., Syst. Nat., ed. x, (1758), vol. i, p. 109—Asia = Bengal.

Specimens collected:—171 ? (imm) 19-10-31 Farāhābād 2,800 ft.; 314 ♂ 14-11-31 Nelipāka 160 ft.; 385 ♀ Pāloncha 300 ft.

Iris brown; bill brownish-black or black; mouth greyish-pink or pale flesh colour. In 171 (imm) the gape and mouth were pale yellow. legs, feet and claws in 171 and 385 slaty brown, in 314 black.

The Magpie Robin is generally distributed throughout the State, haunting gardens, scrub country and sparse jungle. It is also found sparingly in deciduous forest. At Manānūr and Farāhābād (3-22 October) it was observed singly in heavy scrub, shy and retiring, and only showing itself among the thickets rarely. It was silent, and the only notes then uttered were a high-pitched rather mournful *chee-ee* and low *chur-r-r*'s which were some of the commonest sounds in the scrub jungle at dusk. It is perhaps on account of its unobtrusive and silent habits at this time of the year that Butler (*S.F.*, ix, p. 404) considered it only as a seasonal visitant in the Deccan.

3 November (Borgampād) is the first date I have on record on which one was heard attempting to sing. On 30 November it was first heard actually singing from an exposed tree-top. By about the middle of March the singing had increased considerably, until at the last camp, Bhāmarvādi (19-24 April)

males were in full song on every side. Mrs. Tasker notes that on 28 May (1928) it was in full song at Begampēt (Hyderābād City Environs).

A habit, observed by me several times, is worth recording. A bird that has been attracted to the ground on the movement of an insect among the dry leaves, rapidly opens and closes its wings obviously to 'beat out' the lurking prey which has taken refuge in the meanwhile. The effect of this manœuvre is easily perceived if the bird is watched for some time. Immediately after a 'flap' he is seen hopping up to pick the fleeing morsel with which it flies up into the branches above.

Breeding:—I was unable to obtain any satisfactory evidence of its breeding within this area during the time I was in the field. No. 171 (19 October) was certainly a young bird of the season with a soft skull and in heavy general moult. On 30 March a pair was observed at Nirmal distinctly interested in a nesting site (hole in wall), while by the end of April all birds had paired off, and from their generally excited behaviour seemed ready to breed, if not actually doing so at the time.

Col. Sparrow found nests round Trimulgherry from 10 May to 12 July, the majority being in May and June.

Kittacincla malabarica malabarica. (Scopoli). The Shama.

Muscicapa malabarica Scop., Del. Flor. et Faun. Insubr., ii (1786), p. 96—Mahé, Malabar.

(For reasons for this name see Eastern Ghats Report, *J.B.N.H.S.*, xxxvi, p. 74.)

Specimen collected:—340 ♂ 19-11-31 Pāloncha 300 ft.

Iris dark brown; bill horny-black; mouth pale yellowish-pink; legs, feet and claws pale flesh colour.

[This specimen has a curiously short tail—144 mm.—for this race. 12 ♂♂ from the Western Ghats have tails 160-207 mm., and 9 ♂♂ from the Eastern Ghats have tails 160-200·5mm.

Although the Shama is well distributed down the Western Ghats from Khandālā southwards, in the Vizagapatam Ghats and in the Eastern Ghats towards the direction of Madras, this specimen affords the only record between those three areas.—H.W.]

This was the only example met in Hyderābād State. It kept to dense scrub and thorny undergrowth, and was silent.

Testes undeveloped.

Turdus simillimus mahrattensis Whistler & Kinnear. The Black-capped Black-bird.

Turdus simillimus mahrattensis Whistler & Kinnear, *J.B.N.H.S.*, xxxvi, p. 76 (15 Nov. 1932)—Mahableshwar.

Specimens collected:—139 ♂ 16-10-31 Farāhābād 2,800 ft; 655 ♀ 5-4-32 Utnoor 1,250 ft.

Iris brown; bill: in No. 139, upper mandible dark horny-brown; tip and terminal half of lower mandible in No. 655 orange; gape, eye-lids and mouth bright orange-yellow; legs, feet and claws dusky orange.

[It has already been explained in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvi, pp. 75-76) that the name *nigropileus* is a synonym for *simillimus* and the above name was then proposed by me to take the place of *nigropileus* auctorum. No. 139 is a ♂ in first year plumage very similar to that of the ♀. No. 655 is a ♀. These two specimens do not agree exactly with corresponding stages of this blackbird from the Sahyadri range but they are very similar to birds from Raipur in the Hume collection. The series of *T. s. spencei* obtained by the Eastern Ghats Survey on which that race was named consisted entirely of adult ♂♂. Direct comparison is therefore impossible but I am of opinion that these birds will eventually prove to be closer to the Western Ghats form with which I now therefore include them, though doubtless intermediate in character.—H.W.].

It is noteworthy that the above two were the only examples of the Black-capped Blackbird I came across in the State. They were both single and silent. Once at Kandahār (5 March) however, I think I heard the familiar throaty quick-repeated *chuck-chuck-chuck* uttered by this species, in a mango tope adjoining our camp. The bird itself was not seen.

Gonads of the specimens were in an undeveloped condition.

Geokichla citrina cyanotus (Jardine and Selby). The White-cheeked Ground Thrush.

Turdus cyanotus Jardine and Selby, Illustr. Orn., i (1828 April), pl. xlvi—India, Bangalore.

Specimens collected:—339 ♂ 17-11-31 Nelipāka 160 ft; 342 ♂ 19-11-31 Pāloncha 300 ft.; 656 ♂, 657 ♀ 5-4-32 Utnoor 1,250 ft.

Iris dark brown; bare skin behind eye slate colour; bill slaty brown or horny brown, base of lower mandible flesh colour; mouth fleshy pink, greyish-pink or yellowish-pink; legs, feet and claws brownish flesh colour.

Besides the above localities this thrush was only met by me near the Pākhāl Lake. It was nowhere common, but rather more abundant at Pāloncha than in the other localities. I usually found it singly on the ground under thick tangles of roots and stems of *Zizyphus* and other brushwood, where it rummaged amongst the dry leaves for insects. On being disturbed it promptly flies up into the bush where it sits silent and motionless, descending again immediately things are quiet, to resume its quest for food.

Breeding:—Nos. 656 and 657 (5 April) shot in thick deciduous jungle among bushes lining a forest stream, had paired off. The testes of the ♂ measured 3×2 mm. and showed indications of enlarging. In the ♀ also the ovarian follicles were clearly discernible though as yet minute.

In both Nos. 339 (17 November) and 342 (19 November) on the other hand, the testes were in a totally undeveloped condition.

The breeding season apparently coincides with that along the Western Ghats, i.e., June, July and August. At Eswantarāopēt where it is fairly common, Col. Sparrow found 2 eggs on 10 June, and young on 6 August.

Monticola solitaria pandoo. (Sykes). The Blue Rock-Thrush.

Petrocincla pandoo Sykes, P.Z.S. (31 July, 1832), p. 87—Ghauts, Dukhun=Mahableshwar.

Specimens collected:—579 ♀ 19-3-32, 618 ♀ 27-3-32 Kaulās 1,350 ft.; 627 ♂ 1-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Singarenni Collieries, Āsifābād, Hyderābād City, Kandahār, Bāsar, Nirmal, Hanamkonda (Warangal District).

Iris brown; bill dark horny-brown; legs, feet and claws horny-black. In No. 579 the mouth was pinkish flesh colour, but lemon-yellow in the other two specimens.

First seen: 11 October (1928) (Hanamkonda); last 12 April (1932), Nirmal.

The Blue Rock-Thrush was not common anywhere, single birds being met in village precincts, ruined forts, buildings both ruined and inhabited, and among the boulder hillocks as in the environs of Hyderābād City, Hanamkonda and elsewhere. It was silent as a rule, but a male observed capturing insects in mid-air like a flycatcher in Kandahār Fort was singing in loud sweet notes (2 March).

FAMILY: MUSCICAPIDÆ.

Siphia parva albicilla. (Pallas). The Red-breasted Flycatcher.

Muscicapa albicilla Pallas, Zoogr. Russo-Asiat., vol. i (1811, not published until 1827), p. 462, Aves, pl. i—Dauria.

Specimens collected:—120 ♀? (imm) 13-10-31 Manānūr 2,000 ft.; 526 ? 8-3-32 Mūkhēr 1,350 ft.

Elsewhere noted at: Singarenni Collieries, Pāloncha, Kandahār, Deglūr (subspecies uncertain).

Iris dark brown; bill horny brown, lower mandible paler; legs, feet and claws blackish-brown; mouth (in No. 526) pale lemon-yellow and pink.

[I have already pointed out in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, p. 81) that this race is more widely distributed in India than is generally realised; and both these specimens show the characteristics of ♀♀ of this race, namely, the colder, greyer brown of the upper parts, the whiter underparts suffused with grey and the truer black of the upper tail coverts and tail. From south of Orissa I have examined specimens from Anantāgiri and the Nallāmalāis (Eastern Ghats Survey), Bhadrāchalam (Blanford), Satāra (Fairbank), Dahive, Khāndesh (Davidson), and Belgaum (Butler).—H.W.]

First seen 13 October (Manānūr); last 15 March (Deglūr).

This species of flycatcher was rather commoner in the Nānder District than elsewhere. It was usually met singly and seemed very partial to mango groves.

It utters a quickly repeated *click-click*, at times very like that of *Dicæum erythrorhynchum*, as it jerks its cocked-up tail upwards. I have frequently observed it descending to the ground to pick up an insect.

Specimen No. 120 (13 October) was a young bird with soft skull. The other (No. 526, 8 March) was extremely fat and apparently preparing to emigrate.

Muscicapula superciliaris superciliaris (Jerdon,) The White browed Blue Flycatcher.

Muscicapa superciliaris Jerdon, Madr. Jour. Lit. Sci., vol. xi (1840, after May), p. 16—N. Indian Ghats = Ajunta.

Specimens collected:—422 ♀? 5-12-31 Pākhāl Lake 800 ft.; 450 ♀ 8-12-31 Narsampēt. 800 ft.

Elsewhere not noted—possibly overlooked or confused with other spp.

Iris dark brown; bill, legs and feet brownish-black; mouth pinkish grey.

[These provide the most southerly records of this species and race, which has however been recorded already from Ahmednagar (one specimen, Fairbank, *S.F.*, iv, 257) and seen in South Chanda (D'Abreu, Central Provinces List p. 15).—H.W.]

Not common. Met with singly among leafy tops of large trees in mixed forest.

Muscicapula tickelliae tickelliae (Blyth) Tickell's Blue Flycatcher.

Cyornia tickeiliae Blyth, *J.A.S.B.*, xii (1843, after November), p. 941—Borabhum in Maunbhum.

Specimens collected: 112 ? (imm), 113 ♂, 114 ♂ 13.10.31, 127 ♂ 14.10.31 Manānūr 2,000 ft.; 341 ♂ 19.11.31 Pāloncha 300 ft.; 454 ♂ 12.12.31 Āsifābād 1,200 ft.

Elsewhere noted at: Borgampād, Nelipāka, Pākhāl Lake, Mūkhēr, Utnoor.

Iris brown; bill black; mouth blackish-pink, greyish-pink or yellowish pink; legs and feet greyish-brown or pinkish-slate; claws dusky.

[From Nos. 112 and 127 it is evident that the first Winter ♂ and ♀ are indistinguishable in plumage from the adult ♀, a point which does not appear to have been noticed before.—H.W.]

Tickell's Blue Flycatcher is a generally distributed and common species in the Hyderābād State. It is partial to thorny scrub and secondary jungle where it flits about and hunts among the twining roots and stems overhung by a canopy of foliage. Tamarind groves are also a favourite haunt. At Utnoor and Āsifābād I have recorded it as: 'though numerically not abundant, probably the commonest flycatcher'. ♂♂ continue to sing their merry trill although in heavy general moult.

Breeding: No. 112 (13 October) was an immature bird with a soft skull, while from the fresh pin-pointed rectrices of 127 (14th October) it is also evidently a bird of the year. The gonads of all the other specimens—apparently adult—were in an undeveloped condition.

Col. Sparrow found it breeding about Secunderābād in June and July (nests from 20th June to 30th July) and from records from Nasik (Davidson, *J.B.N.H.S.*, iv, 97) and Poona (Betham, *J.B.N.H.S.*, xii, 780 xiii, 398 and xiv, 398) it appears that the breeding season is well-defined in the Deccan, ranging between June and August.

Eumyias thalassina thalassina. (Swainson). The Verditer Flycatcher.

Muscicapa thalassina Swainson, Nat. Libr. Flycatchers, 1838, p. 252—India.

Specimen collected: 420 ♂ 3.12.31 Narsampēt 800 ft.

Elsewhere not noted.

Iris dark brown; bill black; mouth pale yellowish pink; legs, feet and claws slaty black.

This was my only meeting with the species—probably a winter visitor. A single bird perched bolt upright and silent in a large Banyan tree in forest.

Testes undeveloped.

Alseonax latirostris. (Raffles). The Indian Brown Flycatcher.

Muscicapa latirostris Raffles, Trans. Linn. Soc., xiii (1822), p. 312—Sumatra.

Specimens collected: 55 ? 8-10-31, 132 ♂ 14-10-31 Manānūr 2,000 ft.; 686 ♂, 687 ♂, 688 ♀ 9.4.32 Utnoor 1,250 ft.; 722 ♀, 723 ♂, 20.4.32, 738 ? 22.4.32 Bhāmarvādi 2,500 ft.

Iris brown; bill horny-brown, base of lower mandible fleshy-yellowish; gape and mouth yellow; legs, feet and claws horny brown.

[These are all the same bird and agree with those obtained by the Eastern Ghats Survey and also in the Himalayas. I have already explained in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, pp. 85-86) that I cannot recognise any races of this species on the available evidence. The colour and other differences of two supposed races were described at length by Brooks (*S.F.*, ix, 225) and Hume under the same reference explained that they were partly seasonal and perhaps partly individual, and to this conclusion I have independently arrived. In fresh moulted autumn birds the plumage is a cold dark sooty-grey—rather reminiscent of *Hemichelidon sibirica*—and the pale edges of the tertiaries and secondaries and coverts a warm fulvous in contrast: the mottling of the breast is a decided grey. There is no spring moult and with wear the contrasted fulvous edges disappear: the upper plumage becomes earth-brown and the breast mottling a decided brown. This change becomes even more marked post-mortem with storage in the museum. A few specimens in the British Museum are of a third colouration, definitely bright fulvous throughout, but I am not sure whether this is an individual variation or merely a post-mortem change.

More information is needed about the breeding of this Flycatcher in the Peninsula. It has hitherto been only definitely recorded from Sehore (Whitehead, *J.B.N.H.S.*, xxi, 161), the Ghats near Mhow (Shelley, *J.B.N.H.S.*, ix, 223; Betham, xix, 989) and N. Kanara (Davidson, *J.B.N.H.S.*, xi, 668).—H.W.]

In the above mentioned localities the Brown Flycatcher was not uncommon, though perhaps most abundant at Bhāmarvādi, whence I have recorded it as the commonest flycatcher. It was usually met with singly in secondary or scrub jungle, specially in the vicinity of streams, and often in association with *Muscicapula tickelliæ* and *Leucocerca aureola*.

None of the specimens showed any signs of genital development or any other indication as regards breeding.

Alseonax muttui muttui. (Layard). Layard's Flycatcher.

Butalis muttui Layard, Ann. Mag. Nat. Hist. Sci., 2, vol. xiii (February 1854), p. 127—Pt. Pedro, Ceylon.

Specimens collected: 130 ? 14-10-31 Manānūr 2,000 ft.; 137 ? (imm). 141 ♂, 144 ♂ 16-10-31 Farahābād 2,800 ft.

Elsewhere not noted.

Iris dark brown; bill dark horny brown, lower mandible fleshy with a dusky tip; mouth pale lemon yellow; legs and feet fleshy; claws dusky.

[These specimens provide a welcome corroboration of the opinion expressed in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, p. 87), that there is no reason to think this species anything but a winter visitor to Travancore and Ceylon in view of the existing passage records there enumerated. It has already been recorded by Currie (*J.B.N.H.S.*, xxvi, p. 667) at Bolārum, Secunderābād, on 2nd October 1917.

The four specimens obtained are freshly moulted.—H.W.]

All the specimens (on passage?) were secured in thick Bamboo and mixed forest with thorny scrub undergrowth, among whose looping stems and twisting roots the birds sat silent and motionless. They were observed singly and appeared to be fairly common at Farāhābād. I failed to come across this flycatcher on return passage.

No. 137 (16th October) was immature with the skull soft. No. 141 (16th October) was very fat.

Culicicapa ceylonensis pallidior Ticehurst. The Grey-headed Flycatcher.

Culicicapa ceylonensis pallidior Ticehurst, Bull. B.O.C., xlvii (1927), p. 108—Simla.

Specimen collected: 434 ? 7-12-31 Pākhāl Lake 800 ft.

Elsewhere not noted.

Iris brown; bill pale horny-brown, lower mandible flesh colour; mouth pale yellow; legs and feet brownish-orange; soles orange.

[The single specimen agrees well with birds from N.W. India, where it was evidently a winter visitor.—H.W.]

Shot in thick dank forest of evergreen aspect near the Lake, where it was flitting about amongst the lianas festooning lofty trees and making short graceful sallies after winged insects, in company with *Parus*, *Machlolophus* and various *Phylloscopi*. Silent.

Tchitrea paradisi paradisi (L.) The Paradise Flycatcher.
Corvus paradisi Linn., Syst. Nat., ed. x (1758), p. 107—Fort St. George, Madras.

Tchitrea paradisi leucogaster (Swainson).
Muscipeta leucogaster Swainson, Nat. Library, Flycatchers (June 1838), p. 205—India.

Specimens collected: 36 ♂ 6.10.31 Manānūr 2,000 ft.; 663 ♂, 664 ♀ 6.4.32 Utnoor 1,250 ft.

Elsewhere noted at: Borgampād (5th November), Pāloncha (19th November), Kaulās (18th-22nd March), Aurangābād (14 April).

Iris dark brown; eyerim blue of different shades in each specimen; bill blue; mouth bright greenish yellow; legs and feet bluish-grey; claws dusky.

[No. 36 is definitely *paradisi paradisi*. No. 664 is definitely *paradisi leucogaster* by the paler colour of the upper parts and the greater amount of blackish brown in the primaries and secondaries. No. 663 (in white plumage) is therefore presumably of the same race. The races of this flycatcher have already been discussed in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, pp. 88-90) and the question of their migrations has already been outlined in a separate note to the Journal (vol. ? p.). Breeding records and accurate notes on the movements of the Paradise Flycatcher in the Peninsula are badly wanted.—H.W.]

This delightful bird is sparsely distributed in the State. I found it completely absent in many localities and decidedly rare where ŏccurring. Every single individual seen was noted, the list being as follows: Manānūr 1 (specimen No. 36), Borgampād 1, Pāloncha 1, Kaulās 1, Utnoor—a pair (spp. Nos. 663 and 664) Aurangābād 1. The example at Kaulās was in chestnut plumage without tail 'ribbons' and probably a ♀. It was observed in a grove of Tamarind trees where we were encamped, between 18th and 22nd March after which it disappeared.

There were no signs of genital development apparent in any of the specimens. No. 664 was very fat.

According to Col. Sparrow this bird is fairly common in both jungles and cantonments near Trimulgherry. He found nests in that locality between 30th June and 24th August.

Hypothymis azurea styani. (Hartlaub). The Black-napped Flycatcher.
Siphia styani Hartlaub, Abh. Nat. Ver. Bremen, vol. xvi (2), (1898), p. 248—Hoihow, Hainan.

Specimens collected: 239 ♂ ad. 4-11-31, 248 ♂ ad. 5-11-31 Borgampād 160 ft.; 338 ♀ 17-11-31 Nelipāka 160 ft.; 667 ♂ ad. 7-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Pāloncha, Pākhāl Lake. Absent on Amrābād Plateau.

Iris brown; bill, adult ♂ greyish-blue, black at tip, ♀ horny-brown; mouth (both sexes) lemon yellow; legs and feet ad. ♂ slaty-blue, claws dark brown, ♀ greyish-brown, claws dark brown.

[I have already shown in the Eastern Ghats Report, *J.B.N.H.S.*, xxxvi, p. 91, that I am unable to recognise two races of this bird in India.—H.W.]

The Black-naped Flycatcher is apparently absent in the southern and western portions of the State. Utnoor is the most westerly and Pāloncha the most southerly camp at which I have recorded it. It is common where occurring, often in association with *Muscicapula tickilliæ*, *Leucocerca aureola* and *L. pectoralis*. I noted it as the commonest flycatcher in the deciduous forests at Nelipāka where it was met with singly or in pairs. At Utnoor its favourite haunts were shady trees on the banks of forest streams.

Some of the notes uttered by this flycatcher are exactly like those of *Parus major mahrattarum*, and as the two species are frequently found side by side in the same patch of jungle or even tree, the possibility of confusion is heightened.

The gonads of all the specimens were in an undeveloped condition.

Leucocerca aureola compressirostris. Blyth. The White-browed Fantail Flycatcher.

Blyth. The White-browed Fantail Flycatcher.

Leucocerca compressirostris Blyth, *J.A.S.B.*, xviii (1849), p. 815—Ceylon.

Specimens collected:—238 ? 3-11-31 Borgampād 160 ft.; 470 ♂ 15-12-31 Āsifābād 1,200 ft; 647 ♀ 4-4-32 Utnoor 1,250 ft.; 720 ♀, 721 ♂ 20-4-32 Bhāmarvādi 2,500 ft.

Elsewhere noted at: Manānūr, Nelipāka, Pākhāl Lake, Kaulās.

Iris dark brown; bill black; mouth pinkish, sometimes with a yellow tinge; legs, feet and claws black.

[The differences between *aureola aureola* and *aureola compressirostris* have been discussed fully by me in the Eastern Ghats Report (*J.B.N.H.S.*, xxxvi, p. 92. Examined in their light this series is somewhat intermediate, though definitely nearer to *compressirostris*.—H.W.].

A generally distributed species; fairly common in suitable country which consists of secondary and scrub jungle, deciduous forest with undergrowth of bushes, and well-wooded hillsides. It is commonly met in association with other flycatcher species.

Breeding:—Of the specimens, only 720 and 721 (20 April) showed any signs of genital development. The follicles of the ♀ were about 1 mm. in diameter. The testes of the ♂ measured 3×2 mm. and were very pulpy in texture, suggesting that it had lately finished breeding.

Leucocerca pectoralis pectoralis. Jerdon. The White-spotted Fantail Flycatcher.

Leucocirca pectoralis Jerdon, Ill. Ind. Orn., Text to pl. ii (1845 before March)—Nilgiris.

Specimens collected:—119 ♀ 13-10-31 Manānūr 2,000 ft.; 308 ♀ 14-11-31 Nelipāka 160 ft.; 648 ♂ 4-4-32 Utnoor 1,250 ft.; 694 ♂, 695 ♀, 696 ? (juv), 697 ? (juv) 16-4-32 Kannad 2,000 ft.

Elsewhere noted at: Hyderābād City and Environs, Borgampād, Pāloncha, Pākhāl Lake, Āsifābād, Kaulās.

Iris dark brown; bill black; mouth pale flesh colour; legs and feet slaty-brown or horn-brown. In the nestling the bill is yellowish horny-brown with the mouth and gape yellow; legs and feet pinkish brown.

This Fantail Flycatcher is generally distributed and common throughout the Dominions, frequenting gardens, groves of Tamarind and Mango, and sparse secondary jungle. On the whole it keeps to opener and less wooded country than the foregoing, though frequently met in association with the latter and also with other flycatchers. Its song is prettier, with more notes than that of *aureola*.

Breeding:—No. 648 (4 April) had the testes enlarged to 8×5 mm. and was evidently breeding. 694-697 (16 April) are parents and young just out of the nest, and being fed. The testes of the ♂ parent measured L. 7×5, R. 5×4 mm. and were very pulpy in texture, while the ovaries of the ♀ had already reverted to non-breeding condition. It is probable that as is the case elsewhere, this species may have a second brood again in the monsoon, though it would be interesting to ascertain by the marking or ringing method whether in such cases both the parents are always the same. It is also worth investigating as to what becomes of the young once they are old enough to fend for themselves. The pair, or number of pairs, inhabiting and breeding in a garden seems to remain constant even after brood upon brood has been brought up and discharged.

(To be continued.)

"NON-POISONOUS SNAKES".

BY

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Colonel Gharpurey's Note on "Cases of Snake-bite" published in the last number of the Journal gives 4 cases of bites from the following snakes:—

(1) The Trinket Snake (*Coluber helena*). Cases Nos. 1 & 8.
(2) The Common Wolf Snake (*Lycodon aulicus*). Case No. 4.
(3) Red Earth Boa (*Eryx conicus*). Case No. 7.

These snakes are described by the author of the article and generally accepted as 'Non-poisonous' species.

The term 'non-poisonous' when used in connection with snakes has come to be taken at its 'face value'. We describe certain species which are harmful or deadly to man and the larger animals as 'poisonous' and those whose bites produce no serious symptoms, as 'non-poisonous'. Our classification has no scientific basis. The power of poisoning being actually entirely a question of degree dependent on the quantity of venom injected. The poison of a snake is developed to serve one purpose, the overcoming of its prey—incidentally it acts as a digestive and may confer on the owner immunity against, or a resistance to, the venom of other snakes. The majority of snakes are in this sense known to be poisonous. The poison which they secrete enables them to overcome their legitimate prey. But, in certain species, the *quantity* of venom inoculated at one dose may be sufficient seriously to harm or even to kill the larger animals, including man. We usually describe such snakes as poisonous. They are known to be equipped with a distinct gland, usually situated, behind and below the eye, which secretes the poison and discharges it through a duct into a hollow or grooved fang when the reptile bites. Snakes so equipped include our Vipers and the proteroglyphous or front-fanged Colubrines i.e. Cobras, Kraits, Coral Snakes and Sea Snakes.

Now most colubrine snakes which we describe as non-poisonous—colubrines, in which all the teeth are solid (*aglyphous*), and colubrines, in which the posterior maxillary teeth take the form of grooved fangs (*opisthoglyphous*), are, like the more highly poisonous proteroglyphous species, equipped with glands for secreting poison. The gland, known as the *parotid*, is intimately connected with and not readily distinguishable from a chain or chaplet of small confluent glands which lies along the entire inner margin of the upper lip of the snake and which is known as the *supralabial gland*. The *parotid* gland appears to form the upper and posterior part of the salivary *supralabial gland*. Really, it is a distinct gland both in its structure and function. One is able by various methods to distinguish the two glands which form the 'ensemble'. Pressure on the two parts of this apparently single gland will result in a discharge of the creamy secretion of the parotid gland through its own excretory canal, which opens on a level with a fold in the gum at the posterior extremity of the jaw; while the limpid and mucous secretion of the supra-labial gland will be seen to emerge from the string of tiny pores which open on the inner margin of the upper lip. The two glands are distinct. Each is provided with a distinct medium for discharging its separate secretion. The parotid gland is equipped with its own duct which carries its secretion to the base of the posterior teeth of the snake. Its function is homologous to the venom gland of highly poisonous species.

A parotid gland is present, as I have said, in many colubrines which we class as non-poisonous. It is always present in all opisthoglyphous species and is equally present in many solid-toothed colubrines (*Aglypha*). Out of 95 aglyphous species examined by M. Phisalix and Caius, 72 were found to be equipped with a parotid gland. Curiously enough, in some cases, it was found to be present in some species of a particular genus and absent in others. In the genus *Coluber*, *C. radiatus* and *C. porphyraceus* both have a parotid gland while *C. helena*, our Common Trinket Snake was found to be without it. Indian aglyphous colubrines possessing this gland, as recorded by Madame Phisalix (*Animaux Venimeux*, Tom II, p. 394), are as follows:

Coluber porphyraceus.
,, *radiatus.*
Dendrelaphis caudolineatus.
Polyodontophis subpunctatus.
,, *collaris.*
Trachischium fuscum.
Xylophis perroteti.
Dendrophis pictus.
Dryocalamus nympha.
Helicops schistosus.
Oligodon subgriseus.
Pseudoxenodon macrops.
Simotes arnesis.
,, *violaceus.*
,, *tæniatus.*
Tropidonotus stolatus.
,, *piscator.*
,, *parallelus.*
,, *subminiatus.*
Zamenis diadema.
,, *korros.*
,, *mucosus.*
Lycodon aulicus.

Experiments to discover the toxicity of the venom secreted by the parotid gland in these snakes have been carried out by Phisalix, in collaboration with Father Caius and recorded by her in the work to which we have referred. These experiments have established the venomous character of the secretion of the parotid glands in the following Indian species:

Aglyphous Colubrines.
    Tropidonotus piscator.
        ,, *stolatus.*
        ,, *himalayanus.*
        ,, *platyceps.*
        ,, *subminiatus.*
    Zamenis mucosus.
    Helicops schistosus.
    Lycodon aulicus.
    Dendrophis pictus.
    Oligodon subgriseus.
    Polyodontophis collaris.
    Simotes arnensis.
Opisthoglyphous Colubrines.
    Dryophis prasinus.
        ,, *mycterizans.*
        ,, *dispar.*
    Cerberus rhynchops.
    Dipsas forsteni.
        ,, *ceylonensis.*
    Chrysopelea ornata.

Among others, Phisalix records experiments carried out with the venom of the Common Wolf Snake (*L. aulicus*)—a Munia (*Munia malacca*), injected with 2 milligrs. of the extract from the parotid gland of *L. aulicus* died in 5 hours and 30 minutes. A hoopoe injected with a dose of 5 milligrs. was dead in 2 hours and a blackbird (*Merula simillimus*) injected with 4 milligrs. died in 46 hours. The symptoms recorded were drowsiness, difficulty in breathing and muscular weakness. The symptoms became increasingly apparent and culminated in paralysis and the definite arrest of respiration. Autopsy revealed haemorrhage at the seat of the injection and a very congested condition of the lungs. The poison acting dominantly on the respiration recalls the action of the venom of the cobra, while the local haemorrhage is symptomatic of viperine poisoning.

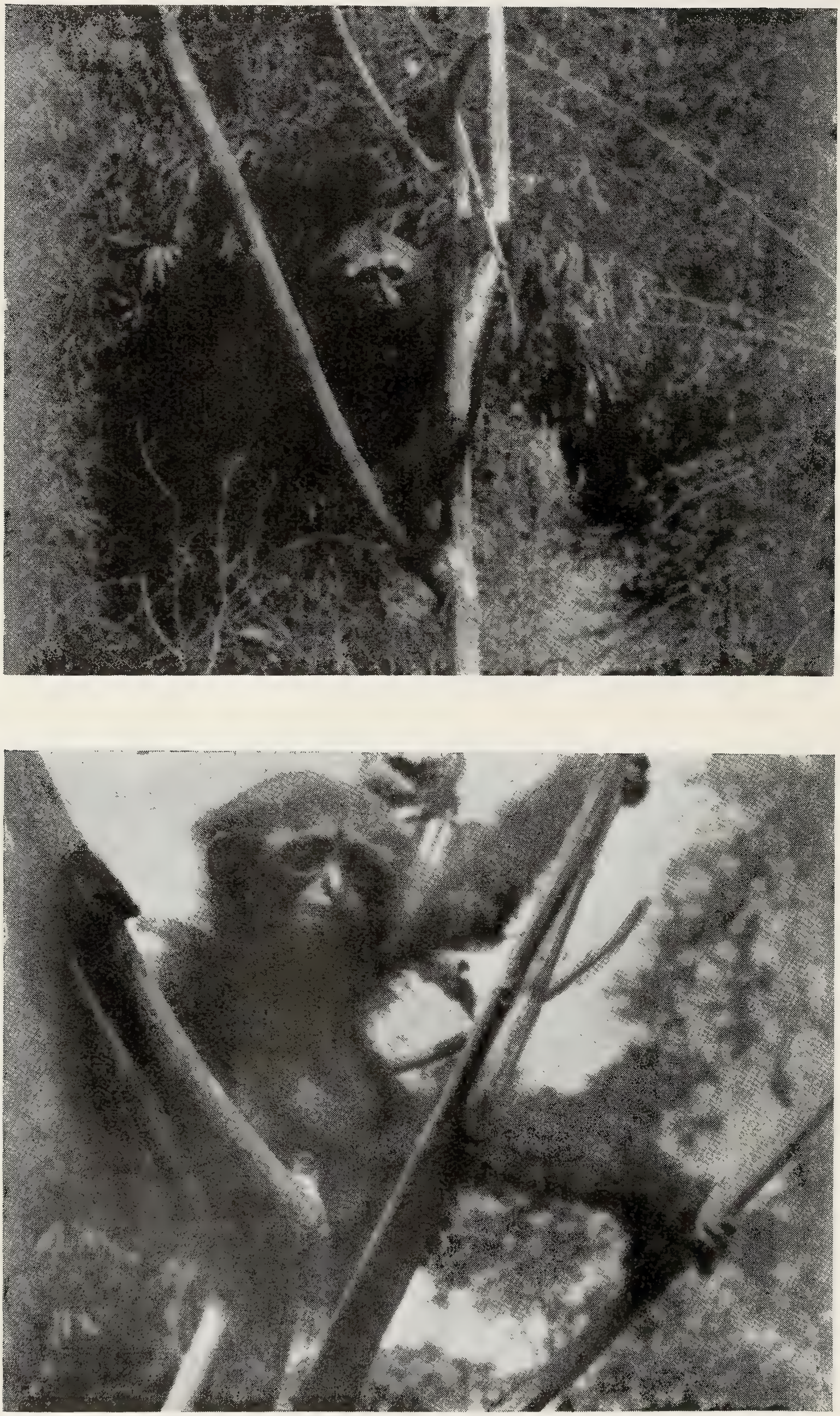
A crow injected with 48 milligrs. of extract from the parotid gland of a Checkered Water Snake (*T. piscator*) died in 7 minutes. For a sparrow the minimum lethal dose, causing death in 4 hours, was 0·25 milligrs.

Alcock and Rogers (*Proc. Roy. Soc.*, Vol. lxx, p. 1902) indicated the intense convulsions produced by the venom of the Dhaman (*Zamenis mucosus*). Dr. Phisalix's experiments confirm those of Dr. Alcock. A pigeon injected intravenously with 4 milligrs. of poison from the parotid gland of a Dhaman, died in acute convulsions in a few minutes.

So much for the colubrine snakes.

As regards the Boas (*Boidae*), the Earth Snakes (*Ilysiidae*), and the *Uropeltidae*, Phisalix and Caius have discovered the existence of a gland more deeply situated than the parotid of colubrine snakes which, like the parotid glands of the colubrines, may secrete venom. The pythons show no trace of a normal parotid gland but the Red Earth Boa (*E. jaculus*) and the Black Earth Boa (*E. johnii*) possess a pyriform gland lodged in a depression of the anterior temporal muscle. Its position corresponds to the position of the venom gland in cobras, kraits, etc. and vipers. Phisalix names this gland the *anterior temporal gland* to distinguish it from the parotid gland. This gland is also present, as indicated above, in some of the Uropeltids. Among them *Rhinophis trevelyanus*, *Silybura nigra*, *S. melanogaster*, *S. pulneyensis*, *Plecturus perroteti*, *Platyplecturus madurensis*, and *P. sanguineus*. As regards the Ilysiids some were discovered to possess both a normal parotid gland and an anterior temporal gland. In the point of view of function, the temporal gland is a poison gland. The *Ilysiidae* therefore have two glands which with other species are both venomous—but the author was not able to verify the venomous character of the parotid gland in these *Ilysiidae*. Among the Blind Snakes (*Typhlopidæ*), the position of the poison gland is intermediary between the temporal gland of the boas and earth snakes and the parotid of the Colubrines. The orifice of the small mouth in these snakes is lined with a dense glandular cordon, representing the supra labial gland. The eye is curiously encased in a large lachrymal gland. Below the eye and above the labial gland, in direct contact with the temporal muscle, there is another large gland which is a poison gland and which Phisalix calls the *temporo-mandibular gland.* The secretion of this gland is characterised by its minute quantity and the great toxicity of the venom, as indicated by various experiments carried out with the extract from the mandibular glands of these snakes.

The records which I have quoted indicate that the great majority of snakes are poisonous, inasmuch as they are equipped with particular glands whose function is the secretion of poison and the purpose of which is to kill or paralyse their prey. Fortunately, the peculiar structure of these glands, parotid or temporal, prevents the storage of large doses of poison and these snakes, though poisonous, cannot seriously harm man or the larger animals. It is not a question of the potency or toxicity of the venom. The snake's potential power of poisoning is, as I have said, limited only by the quantity of poison it can inject at a single dose. Certain species, which we now describe by the term *poisonous*, possess venom glands which can secrete and store enough poison to harm or destroy animals many times larger than their normal prey, but, even in this case, a bite from these highly venomous species may not prove fatal. Death or the gravity of the symptoms resulting from the bite would depend entirely on the amount of poison injected into and absorbed by the system.



A young White-browed Gibbon (*Hylobates hoolock*, Harl.), female.
(About two months old.)

Photos by Author.

NOTES ON THE COLOURATION AND HABITS OF THE WHITE-BROWED GIBBON OR HOOLOCK (*HYLOBATES HOOLOCK* Harl.).

BY

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(*With 2 plates*).

In January 1930, I was sent on special duty to collect material for a Gibbon group, on behalf of the American Museum of Natural History, New York. The Naga Hills were selected as a suitable venue for the expedition. An artist, a modeller and myself composed the members of the expedition. Our camp was situated at a place called Changchang Pani (*Changchang Tsu*), twelve miles from Nakachari Railway Station. Changchang Pani is situated at an elevation of 500 ft. above sea level, with the hills of Lakhuni rising to about 2,000 ft., near by. It is on the 'high road' between Nakachari and Mokakchang, and is the halting place for the Nagas on their way to and from their *busties* in the interior. The hills are covered with dense evergreen forest with barely any footpaths through them. In consequence, one's movements are restricted to the watercourses. Bamboo is the predominant species—a species with a very hollow stem.

This expedition offered me a splendid opportunity for observing the White-browed Gibbon in its natural environment. At Changchang Pani I spent nearly two months doing little else but observing these animals. The forests were literally teeming with gibbons, which could be heard on all sides. But owing to the dense nature of the jungle, they were not always easy to get at. By careful stalking, I was successful in obtaining the specimens required and also in observing their habits. The gibbons were not always very shy, but owing to constant persecution by some of the Nagas for food, they were rather suspicious of one's movements. I spent much time with glasses and gun trying to study their ways. My observations, which I detail below, it will be observed, are not always in agreement with the observations of other naturalists. It is possible that many recorded observations of the habits of these animals have arisen from statements made by natives. Long experience has convinced me, if conviction is necessary, that statements of natives are frequently wrong. Not that the folk tell the story with the idea of deceiving, but they often let their imagination and superstitious beliefs obscure the true facts. The story is usually based on certain facts which need careful analysis, and this is pardonable in ignorant folk. How much more aggravating is it to listen to educated people who in all seriousness glory in narrating stories after the manner of 'Col. Longbow'.

It has been generally understood that *both* the males and the females of this gibbon vary in colour from brownish-black to yellowish-grey. As far as my observations go this change of colour, if we exclude the change undergone by the newly-born young, is limited to the female sex.

It has been generally understood that both the males and the females of the Hoolock vary in colour from black to yellowish grey.[1] My observations, however, are not in accord with the generally accepted statement. I am of opinion that the change of colour is restricted to the adult female.

The young of this gibbon at birth is a pale greyish-white with a yellowish tinge. The face, the palms of the hands, the soles of the feet are black. As growth proceeds the coat becomes darker and darker, usually with lighter patches around the rump, but finally it gets quite black. Both sexes pass through this change with this important difference. The dark colouring, deepening with age to glossy black, is retained by the *males through life*: in the case of the female *a second change* is undergone when she reaches puberty. Her black fur fades gradually to the light yellowish brown phase referred to frequently by various authors.

The change from the greyish-white of the new-born gibbon to the dark colouring exhibited in the juvenile stage makes it particularly difficult to see whether a female has a young one at her breast or not. Though the dorsal fur of the mother is pale the brown skin of her ventral surface, sparsely clad with hair, harmonises with the dusky colouring of the baby gibbon at her breast.

Of all the gibbons that I shot (and I shot nearly thirty including males, females, and young of all ages) I never secured a *black* female with young, nor did I see a single *black* female with young among the numerous parties that I observed. Among the specimens that I secured, there was a single female which showed a partial change of colour in her coat. Judging from this specimen, it appears that the limbs change colour in advance of the body, particularly around the hindquarters. However, this may vary with different individuals. There is no sign of moult at this period but a gradual canescence of the hair. In all cases I examined the ovaries and uteri of the females with the black coat and in every case was sure that they had never at any time given birth, not even the one that was undergoing the change of colour. The Nagas hold the same view, viz., that the females are always lighter in colour than the males. This change of colour may possibly amount to a secondary sexual character indicating that the animals have reached maturity.

In the *Fauna of British India*, Blanford writes:—"Many individuals, however, both males and females, vary in colour from brownish-black to yellowish-grey, the frontal band being always conspicuously paler." And further on, "Blyth thought that the males only were black, the females always paler; but this is certainly not the case, the females, however, are more frequently pale-coloured than the males''. Blanford's contradiction of Blyth's opinion is so far correct, that the young females are black until the time they reach maturity when the change takes place. But to say that the females 'are more frequently pale-coloured than the males' is, as far my observations go, certainly not the case, for all mature females are pale.

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[1] Blanford, 1888. *Fauna of British India* (Mammals), p. 6,

Pocock[1] in a note on the Hainan Gibbon writes as follows:—''I am informed by Mr. de St. Croix that the young of both sexes of this species are alleged by the natives to be lighter-coloured at birth and for a short time afterwards than their parents. His animal (Pocock refers to a specimen deposited by de St. Croix at the Zoological Society's Gardens) when purchased, was a dark smoky grey, which, however, soon turned black; and perfectly black she remained all the years she was in his possession. But in a few weeks of being brought to the Gardens she began to go grey, Mr. de St. Croix himself noticing a decided alteration in this respect when he visited her on March 8th., about six weeks after her arrival in London. During the spring and early summer the greyness progressed rapidly, but not quite uniformly all over the body. In midsummer, according to my notes, the head was black with a grey band extending on each side of the eyebrow over the ears; the beard was whitish and the nape of the neck blackish; the greater part of the body was blackish-grey, with a considerable quantity of blackish hairs on the sides of the belly close to the thigh and a broad triangular black patch narrower posteriorly, extending from the collar-bones on the fore part of the belly and bordered on each side by a grey area paler in tone than the back; the thigh and upper arm were paler than the distal portion of the limbs. By this time she was not recognisable as the same animal that reached the Gardens in January. Still the greyness continued to spread, the black pigment died out from the areas mentioned above, lasting longest upon the chest and the crown of the head. At this period she presented a decided similarity to the left-hand figure on the plate depicting *H. pileatus* Gray (*P.Z.S.* 1861, p. 136, pl. xxi), although the black pectoral area was smaller and the patch on the crown less sharply defined at the edges. In the early autumn she was a stone or silvery grey practically all over except for a blackish median band, fading away laterally and posteriorly, down the middle line of the head.'

Pocock goes on to describe the change as it comes about and then writes:—''. . . But, so far as I am aware, it was not previously known that a given individual after reaching maturity may change colour in the way exemplified by Mr. de St. Croix's specimen.'' This I am convinced is really what takes place in the female of the Hoolock and I do not hold any doubts on the subject. Further Pocock asks the question: ''Is this canescence then a matter of sex and exhibited only by the mature females?'' and goes on to say, ''The balance of the evidence seems to be on the whole in favour of an affirmative reply to the question. For, apart from the changes here recorded of the only adult female known, it must be remembered that Mr. Swinhoe, in his published account of the information respecting the Hainan Gibbon he was able to gather, quotes from the Chinese Gazetteer of the Kiung Shan district of the island a passage stating that the male is black and the female white (*P.Z.S.* 1870, p. 244, etc.).''

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[1] Pocock, 1905. Observations upon a female specimen of the Hainan Gibbon (*Hylobates hainanus*), now living in the Society's Gardens. P.Z.S., Lond., vol. ii, p. 172.

Here we have a parallel case to that which I have just recorded with reference to the Hoolock. A young female which I secured alive in February (1930), which was about a month old at the time of her capture, was a dusky colour when I first got her, but since then till the time of her death, in November 1931, she gradually got darker and darker till she was almost quite black.

Now we may as well ask why it is that so many have stumbled into this error? There is probably only one answer to this question, and that is, that they were unable to correctly determine the sex of the specimens in hand, or were satisfied with a superficial examination. But still further, the change of colour that takes place when the females reach maturity was not known to them. I must confess here that I fell into the same pit with the first two or three specimens of immature females. The reason for this is not far to seek—it is extremely difficult to sex this gibbon from a superficial examination as the females possess a peniform clitoris, which is almost as long as the penis of the male. Both the organs (penis and clitoris) are very similar in appearance. Zuckerman in a paper on *The Menstrual Cycle of Primates* (*P.Z.S.* 1930, pt. iii, p. 699) refers to this point in the following words:—''It might be noted in passing that there is less sexual dimorphism in the *Hylobatidae* than in any other primate family. Field workers, and even systematic zoologists, frequently experience difficulty in distinguishing the two sexes. The lack of cyclical variation in perineal form adds greatly to this difficulty.''

In a subsequent paper on the Gibbons of the genus *Hylobates* (*P.Z.S.* 1927, p. 719.), Mr. Pocock giving the characters of *Hylobates concolor*, described previously under the name (*hainanus*) states that one of its distinguishing features is ''the presence in the female of a long clitoris, grooved below, which depends beneath the vulva simulating the penis of the male''.

Hylobates concolor was originally described by Harlan (*Journ. Acad. Nat. Sci.* Philad., v. pt. 2, p. 231, pls. ix and x, 1837) from Borneo, and Mr. Pocock in referring to this species in the paper doubts its origin from this Island. He writes 'from the positive evidence supplied by the colour and by the *structure of the clitoris* the conclusion seems unavoidable that the specimen to which the name *concolor* was given came from Hainan or the adjoining mainland Tonkin and not from Borneo'.

Now from the observations I have made in regard to the structure of the clitoris in the Assam Gibbon which is apparently the same as in the Hainan species—*H. concolor* might equally have come from Assam—it is obvious that this particular character is of no value for purposes of differentiation between the species.

In this connection it might be of interest to add Pocock's remarks under the subtitle of *Determination of the Sex* in the paper already referred to above, on the Hainan Gibbon. He writes:—"When Mr. de St. Croix brought the specimen to the Gardens he informed me that she was a castrated male; and in support of his opinion drew my attention to the large size of the clitoris, which he most naturally mistook for the penis. The naked and turgid labia of the vulva he regarded as the unhealed wound caused by castration; and the menstrual discharge which first appeared in December of 1903, when the Ape was on her way to England, he attributed to normal bleeding induced by enforced sitting on the hard floor of her travelling box. He also told me that it was commonly believed in Hainan that female specimens of the Gibbon are never brought to the coast and are practically unobtainable.

"There can be no doubt that this belief, coupled with the peniform clitoris of the Gibbon, misled Mr. de St. Croix as to the true sex of his animal, the castration of which, he admitted, he had not himself witnessed. And it seems probable that the belief itself is traceable to the repeated mistakes on the part of Europeans in determining females as castrated males on account of the length of the clitoris in these Apes as compared with the same organs in the Monkeys of the Old World, generally. In this connection it is interesting to recall the fact that Dr. Harlan, after the dissection of the genital organs, described his specimen of *Hylobates concolor* as 'an hermaphrodite Orang Outan'. It appears to me, however, that Lesson's criticism of this opinion was perfectly justifiable and his decision that the specimen was an immature female undoubtedly correct. Pousargues, also, who did not know Lesson's paper, came independently to the same conclusion, and stated in the type of *Hylobates nasutus*, a young female, the clitoris was well developed and grooved below; and that the animal resembled in every particular, so far as the generative organs were concerned, the Gibbon determined as hermaphrodite by Harlan. And since Harlan and two other doctors, presumably acquainted with human anatomy, who assisted at the dissection, were decided as to the true sex of the specimen, in spite of the best possible opportunities for investigation, it is no wonder that Europeans living in Hainan fall into a similar mistake.

"So far as can be seen, the clitoris of the Hainan Gibbon is like that of the specimen figured and described by Harlan, which resembles the penis of a primate in a state of hypospadias. A comparatively slight modification would convert such an organ into a closed tube for the passage of urine—a fact perhaps of some significance in connection with the low position of the Gibbons in the Anthropomorphous series, seeing that in the Lemurs, the lowest existing Primates, the clitoris is traversed by the urethral canal."

Up to the present we have been dealing with the mistaken sex identity of the female, but what of the sexual characters of the male? In the male there is no distinct scrotal sac which is such a prominent character of most male monkeys, particularly the Macaques. The testes are situated rather high up, almost in the groins. The genital organs are hidden from view by a tuft of long preputial hairs which completely conceal the greater part of the penis. Both the clitoris and penis are very similar in appearance, except for the fact that the penis forms a closed tube while the clitoris is open along its length on the ventral surface. In both cases the organs are directed obliquely backwards. In the male the penis protrudes a little beyond the tuft of preputial hairs, thus preventing the animal wetting its fur when urinating. This tuft of hairs is not very evident in the young males, probably being developed later in life. The preputial hairs though generally black are frequently mixed with grey hairs. The penis is little in excess of the clitoris in length and it is on account of the close resemblance of the two organs that the determining of the sex forms a stumbling block for the unwary. This really explains why so many have erred in connection with the colouring of these animals.

Pocock, writing on the Gibbons of the genus *Hylobates*, makes the following remarks:—"Judging from the material at his disposal, Blyth thought that the two colour-phases of *H. hoolock* were sexual, the males being black and the females brown. This view was quite correctly disputed by Blanford, but was revived by Elliot in 1913. It is nevertheless approximately true. All the male specimens I have seen exhibited the black phase and all the females, except one, the pale phase. This exceptional female, which the collector erroneously sexed as a male, came from H'Kamti in Upper Chindwin. She is black, faintly tinged with brown, and has some greyish hairs on the sides of the face and a dirty white patch behind the chin."

Pocock states that all the black specimens he had before him were males with the exception cited above, and that all the females were pale coloured. Is it not possible that among the specimens that showed the black 'phase', there were one or two examples of juvenile females wrongly sexed by the collector? Surely, the collector did not obtain exclusively *mature* males and *mature* females out of the number he collected! It appears that Pocock was led to re-examine the sex of the 'exceptional female' only because it showed the changing phase and on this account was not prepared to accept the sexing of the collector. It would be interesting to know whether Pocock also checked the sex of each of the specimens showing the black phase, or accepted the sexing of the collector. I have already indicated the difficulty of recognising the sexes in the cases of freshly killed males and females. If the collector made a mistake with the sexing of this individual, is it not possible that he also wrongly sexed some of the others?

In my opinion this gibbon has a definite breeding season which is during the cold weather. Almost every mature female I came across between January and early March was with a baby, clearly indicating that the maximum birth rate is during the cold season. The young appear to be born between November and February.

As indicated above, the young when born is almost white with a yellowish tinge. As far as I was able to observe, it clings to its mother always with one teat of the parent in the mouth, even when she is swinging about in the branches. When born, the young is without teeth, but soon after it gets a full complement of 24 milk-teeth. The second set of teeth appears between the age of eight or nine months (this observation I conclude from the specimen that I had in captivity). The permanent teeth appear slowly and very irregularly—the incisors are the first to appear. My specimen was about a month old when I got her in February (1930). In September of the same year, the permanent teeth began to appear. At the time of her death in November, 1931, not all the permanent teeth had appeared.

The colour of the baby I had in captivity, when I first secured her was dusky, with lighter patches around the callosities. She gradually became darker and darker in tone. At the time of her death she was almost quite black, but still retained the lighter patches around the callosities. There were also a few light-coloured hairs in the beard. The white brows were very conspicuous—from birth this point is very prominent. The callosities are not very evident and are usually covered over by the surrounding hair. This condition also prevails with the adults.

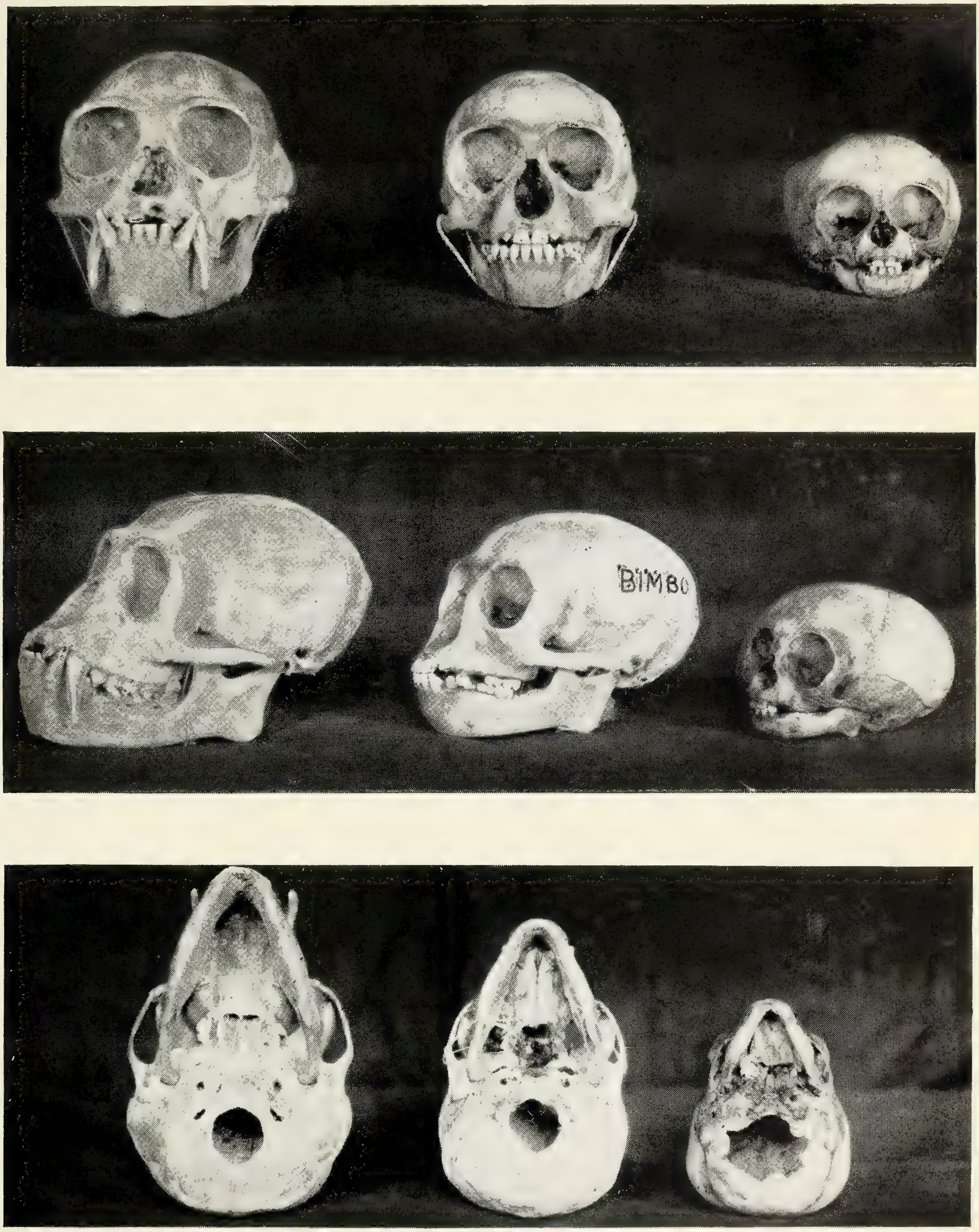
With regard to their habits, Blanford (l.c.) writes:—"Like most other Gibbons the Hoolock is found associating in flocks, often comprising from fifty to a hundred individuals, or even more. An old male, however, is occasionally found solitary." This is yet another point on which my observations differ. These apes are at the best of times difficult to seen when they are in dense forests, and the din created by a party of them, which is soon taken up by another party near by, and so carried through the jungle, often does give one the impression that there is a very large number of them together. This was also my opinion when I first made their acquaintance when I was in Assam in 1918, but at that time I did not see many of them. Different parties will meet within reasonable distance without molesting one another, but this is no evidence that they all belong to the same party. I have found that the Hoolock goes about in small family parties, usually consisting of an adult male and female with young of different ages, the youngest sticking to the breast of the mother. The largest party I have observed consisted of seven individuals, an adult male and female and five young ones, the youngest of which was clinging to the mother's breast. Mackenzie, who collected specimens of this species for the Mammal Survey of India, writes, "It is generally found in parties of three or four, but I have seen single ones, and once a party of six." (*J.B.N.H.S.*, xxiv, p. 762.) Wells notes:—"The Mishmis say that there are only three parties of these Gibbons, each about ten or twelve in number, in the Dening District." (*J.B.N.H.S.*, xxxi, p. 385.) This statement is based on hearsay, but is more in accordance with the true habit of the animals than the statement by Blanford.

Zuckerman in his recent work entitled *The Social Life of Monkeys and Apes*, p. 23, writing in reference to the Lar Gibbon, (*H. lar*) says, "The Lar Gibbon, one of the lesser apes, is unanimously reported to live in small family parties, while the Hoolock gibbon, is found only in large troops." Further on, p. 180, the same author quotes Kloss, "The statement that gibbons are monogamous is one that I thoroughly agree with: whether however they divorce each other and take new partners from time to time we have yet to learn. The point is interesting, since such an able reasoner as Westermarck has come to the conclusion that the marriages of mankind are an inheritance from some ape-like progenitor." I am also inclined to the belief that the Hoolock is monogamous. The reason for this belief is based on the fact that a pair of adults is always found together with their young of the present and preceding years, a single baby being born each year. It appears strange that so closely related gibbons should have such different social habits. It seems to be well established that the Lar Gibbon lives in family parties, and my own observations convince me that the Hoolock has also the same habit of living in family parties.

Frequently a male may be seen feeding alone, but somewhere in the offing the family is out of sight. On one occasion I came across a 'solitary' male feeding on the flowers of the Silk Cotton Tree (*Bombax malabaricum*), so I watched his movements unnoticed. After a short while he gave a low call which was soon followed by the appearance of a female and her young ones (two in number) and they also commenced feeding on the flowers. I watched them for some time, before the four of them fell victims to my gun. On another occasion I came across a solitary female, which was completely fawn coloured, but as I was in need of the mature females she was soon brought to bag. There were no others in the neighbourhood and of this I made certain. Judging from this case, it appears that when a female has reached maturity and has completely changed from the black to the fawn phase she is either driven out of the family or leaves it of her own accord in search of a mate; however, this point is open to question.

It appears to me that the family tie is exceptionally strong with these animals, which I conclude from the following facts. One day I came across a small party of three, consisting of one adult male, one partially grown young one and a baby about four (?) months old. I secured all of them. All were black and both the large ones were males. The baby was clinging to the older one as though it were its mother. The baby was a female. I searched the neighbourhood to see if there was a light-coloured female about, but without success. This incident goes to confirm the Naga belief that in the event of the death of the mother, the other members of the family help to look after the baby.

Judging from the number of individuals that go to compose a family, it appears that it must take four to five years or perhaps six years before this gibbon reaches maturity, and in the case of the females, turn light-coloured. After reaching maturity they probably leave the old family party or are turned out of it to fend for themselves.



Left: adult. *Centre*: 21 months old. *Right*: newly born.
Skulls of the Hoolock Gibbon (*Hylobates hoolock*, Harl.) showing the skulls
at different ages which clearly show the contours of the skulls
and the condition of the teeth at different ages.

Gibbons spend the greater part of the day in high trees, but not just the highest, except in the case of the trees, which afford them food. But during the hottest part of the day frequently descend into the low tiers of the jungle. During the early hours of the morning gibbons may frequently be seen sunning themselves on the exposed branches of trees. When alarmed, they take refuge in the bamboo clumps and use them as a means of getting away swiftly. They will also take refuge in the foliage at the tops of high trees or hide in the forks of thick branches peeping 'round the corner' when they do so. The speed at which they can cover long distances is surprising. The alarm call is a sharp short rather harsh bark, which may be repeated, but alarm may be expressed by quite another sound which may be likened to a loud belch, which is repeated from time to time.

At about 9 a.m. (local time) they commence their 'joyous' howling which is so characteristic of gibbons. This is kept up till a little before noon and then all is quiet till about four in the evening. In the evening the howling does not continue for long. The voice is very powerful and may be heard over long distances. To utter this (and every other vocal expression) the lips are used; the lips are brought round in almost the same shape as a person pronouncing an O with a pout. Each time the sound is made it is accompanied with a toss of the head. The call seems to sound like a long 'hooo-oo', by first expelling the breath and the same sound repeated by taking in the breath. In this way I was able to imitate the sound with a fair degree of accuracy. This cry is repeated several times in the same manner. The 'music' is commenced in a very high key by one of the party (possibly by one of the young ones) and is then taken up by the rest and repeated over and over again. Amid the 'altos', 'sopranos' and 'falsettos' is to be heard the deep bass of the male. The call is taken up by other parties in succession or in concert with the one that started it. Besides the sounds already described there are a number of other sounds which defy description. When eating, a Hoolock generally makes a belching sound after each mouthful, as though to express satisfaction. A whining noise is also made which is altered in tone to suit the occasion, which may mean displeasure, or is uttered when the animal is pleading for something. These sounds are produced by stretching the lips across the mouth as though it were trying to smile. When angry, the mouth is opened, baring all the teeth in true 'monkey fashion', at the same time staring hard at the object which gave rise to the anger. When irritated, they frequently strike out with their long arms instead of biting, but may also use their hands to pull the object nearer and then inflict a bite.

In the trees their mode of progression is by means of swinging from branch to branch, either with the hands alone, or with the hands and feet, though the former is the commoner practice. They are able to drop down considerable distances from one branch to another and are also capable of making prodigious leaps. But when on a thick bough they walk erect along the top of the branch using the arms as a means of balance and support. It is surprising to see how rapidly they get along among the spiny branches of the *Bombax* as though there were no spines at all.

On the ground they are exceedingly rapid for their small size. They run along quite erect, with the chest thrown forward and the two arms swinging on either side to keep their balance. But, they are not able to travel great distances in this way at one stretch. From time to time they stop and rest on the back of their wrists, but not on the palms of the hands. On the whole the gait is most awkward. Gibbons in the dense forests rarely descend to the ground. At Charelli, I have seen gibbons leave the forests and come into the village to feed on the flowers of *Bombax*. As many of the trees were isolated, they had of necessity to come down to the ground before they were able to get to them.

When sitting and sleeping, they assume most human attitudes. In the wild state gibbons sleep in a sitting position with the knees drawn up under the chin, the head and face buried between the thighs and the body, in such a way that all the fleshy parts appear to be protected against the attacks of mosquitoes. The specimen I had in captivity frequently slept in a reclining posture particularly when she was very young.

The stomach contents of the animals I secured revealed large quantities of fruit, some of which were eaten almost whole, leaves and flowers, generally too far gone to enable me to identify anything with certainty. The petals, cotton and seeds of the *Bombax* are largely eaten by these apes. Judging from the specimen I had in captivity, they also eat certain insects and spiders. When eating a large fruit they frequently hang from a branch with one hand and use the other three 'hands' for securing and turning it about. The feet are also used for holding things when travelling along a branch to a convenient seat.

Gibbons drink water from the leaves. In the Naga Hills, where the forests are exceedingly humid, and the dew fall very heavy, gibbons may be seen collecting it directly by means of the tongue or with the hand. In captivity they follow the same procedure. They will also try to lap, only just getting the tongue wet, and in this way it takes them a long time to drink anything. The hand is generally put into the liquid which is sucked off from the back of the hand.

Judging from the specimen that I had in captivity, they do not excrete during the night, once they have retired, till the next morning. This may possibly be a provision of nature so as not to give away the position of the animal to prowling nocturnal enemies. These animals are exceedingly frightened of the larger birds of prey, and I have no doubt that many of them fall victims, particularly the yearlings, to some of the eagles. Probably pythons also prey on them. The specimen I had evinced great fear of snakes and tiger or panther heads.

A very noticeable point about gibbons is that they do not possess that peculiar odour, which is such a common feature with most monkeys, particularly the Macaques.

Blanford rightly remarks that gibbons are easily tamed. When caught young, they make the most delightful pets and become very attached to their master. They are very gentle and good-natured, but at the same time are very sensitive. They do not like to be left alone and should always be given something in the way of a ball or toy to keep them occupied. The face is very intelligent and full of expression. The one I had was always on the move and not at all inclined to be morose. Her greatest delight was to be with the children and she looked forward to going out with them in the evening. In fact, she became so attached to my two boys that she would not allow a stranger to touch them. Under such circumstances she would invariably nip the outsider. When I first obtained her, I fed her on bananas and condensed milk (fresh milk was not procurable). On this diet she thrived well, but when I got back to civilisation I changed her diet to fresh milk and fruit. She refused hard fruits and nuts till she began to get her permanent teeth.

In the cold weather these animals should be provided with a piece of blanket to cover up with as they are very susceptible to chills in captivity.

THE GAME BIRDS AND ANIMALS OF THE MANIPUR STATE WITH NOTES ON THEIR NUMBERS, MIGRATION AND HABITS.

BY

J. C. HIGGINS, I.C.S.

PART I.

The Manipur State, situated in the heart of the tumbled mass of mountains separating Assam from Burma, consists of a broad open valley, some 750 square miles in extent, entirely hemmed in on every side by range after range of hills. The nearest points of the Assam and Surma valleys of Assam and of the Kabaw valley of Burma are respectively some 55, 50 and 25 miles distant from the Manipur valley in an air line. The altitude of the central valley is approximately 2,500 ft. above sea level, while the surrounding mountains of the State, covering upwards of 7,500 square miles, rise from low foothills to peaks just short of 10,000 ft. Roughly speaking, the western portion of the State drains into the Surma valley and the eastern into the Chindwin river of Burma.

The Manipur valley is thickly populated, and almost all the available land is under cultivation, except at the foot of the hills surrounding the central plain. But the six large and numerous small streams which drain into it all combine to flow out again through one narrow gorge in the hills, with the result that the southern part of the valley is covered by a succession of lakes, marshes and bogs. These, sparsely inhabited by a few fishing villages and of necessity only thinly cultivated round their edges, are the resort in the winter of large numbers of waterfowl. At the foot of the grassy slopes immediately surrounding the valley are found partridges and quail, while the tributary valleys and the headwaters of the main streams are the home of jungle fowl, pheasants and hill and bamboo partridges. Small game is also to be found in the mountainous tracts, but the forests which cover the hills, broken only by scattered villages of hillmen and their fluctuating cultivation, are mostly too thick to allow of successful shooting. These forests vary from the dense, moist bamboo and evergreen jungle of the high peaks and the western hills to the more open pine and oak woods of the east and south.

The following are the records of game birds shot in the State (including a few shoots in neighbouring districts) since 1910-11, taken from the Game Book of the Manipur Club. From 1910-11 to 1914-15 they are compiled almost entirely from the Game Book of one member, but from 1915-16 up to date the records are practically complete. The number of birds shot has increased of late years, owing to the greater mobility afforded by motor cars. Another cause of larger bags of duck is to be found in the substitution (about 1917) of shooting from butts for prowling round the *bils* in boats, with an occasional impromptu drive over an island or belt of reeds. The butts consist of bamboo platforms, concealed by a surrounding fence of reeds stuck in the mud: their position is usually changed at each shoot, according to where the duck are flighting and settling at the time. Changes in the conformation of the *bils*, due to variations in the flood level and in the growth of reeds, grass and floating water weeds, preclude any attempt at making permanent butts, as in some of the larger shoots in India. Further, the results from year to year, apart from their dependence on migration, vary with the climatic conditions of the year and are also affected by the tastes of the officers stationed in Manipur and the exigencies of their duties. For instance, during 1918 and 1919, and in the spring of 1931 and 1932 operations in the hills very greatly reduced the amount of touring and shooting in the valley, where the snipe and duck are found. Again, deficient rainfall in 1931 and a consequent complete absence of floods during the rains produced a prolific growth of grass and water weeds in the smaller lakes and marshes, thereby materially affecting the duck shooting of the cold weather of 1931-32.

Following on the records are some notes on local game and water birds, with special reference to their numbers, migration and habits, and on the wild animals of the State, from observations made during seventeen shooting seasons in Manipur.

RECORDS OF GAME BIRDS SHOT IN MANIPUR STATE, 1910-1932.

	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18
Geese.								
Grey Lag Geese ...	17	454	273	103	237	352	76	22
Bar-headed Geese ...	...	11	1	1	8	...	...	...
White-fronted Geese ...	...	...	...	...	...	1	...	...
	17	465	274	104	245	353	76	22
Ducks.								
Pink-headed Duck ...	1	...	...	...	...	...	...	...
Cotton Teal ...	8	41	14	24	42	29	14	9
Lesser Whistling Teal ...	20	46	71	70	73	141	50	87
Common Sheldrake ...	...	...	...	...	...	...	...	...
Ruddy Sheldrake ...	1	6	4	1	4	6	7	9
Mallard ...	...	...	1	1	...	...	...	...
Spotbill ...	78	143	80	105	128	127	114	136
Eastern Grey Duck ...	...	...	...	...	...	...	...	...
Bronze-capped Teal ...	...	...	...	1	...	1	3	1
Gadwall ...	22	41	141	68	100	339	186	85
Widgeon ...	1	2	9	8	18	44	19	14
Common Teal ...	29	76	191	175	234	504	482	364
Baikal Teal ...	...	...	1	...	...	1	...	...
Pintail ...	12	39	91	70	96	144	76	36
Garganey Teal ...	65	124	289	234	462	314	203	67
Shoveller ...	3	30	80	31	84	102	72	51
Red-crested Pochard ...	1	3	...	4	5	4	...	1
Common Pochard ...	4	32	100	155	104	295	139	31
White-eyed Pochard ...	10	46	96	73	93	153	97	74
Baer's Pochard ...	...	...	1	...	1	3	...	...
Scaup ...	...	...	...	...	...	...	...	...

	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18
Ducks (contd.)								
Tufted Pochard ...	26	145	450	403	557	479	256	193
Golden-eyed Pochard ...	...	...	...	...	...	...	...	...
Hybrid Duck ...	...	...	...	...	1	...	...	...
Duck and Teal, unclassified ...	...	...	...	...	58	59	101	...
	281	774	1619	1423	2060	2745	1819	1158
Snipes								
Woodcock ...	...	1	...	1	1	13	3	...
Wood Snipe ...	6	1	1	...	5	3	20	3
Solitary Snipe ...	...	...	...	...	...	...	1	...
Fantail Snipe ...	23	671	582	715	910	890	1470	1076
Pintail Snipe ...	59	618	327	311	456	848	964	603
Jack Snipe ...	4	2	22	15	13	81	36	17
Painted Snipe ...	2	21	41	59	45	80	103	22
Snipe, unclassified ...	1043	...	...	...	45	313	78	245
	1137	1314	973	1101	1475	2228	2675	1966
Plovers.								
Golden Plover ...	9	24	12	37	65	37	57	15
Other plover ...	3	1		9	4	1	9	...
	12	25	18	46	69	38	66	15
Pheasants.								
Burmese Peafowl ...	...	...	...	...	...	...	...	..
Jungle-fowl ...	4	..	...	4	16	4	4	13
Black-breasted Kalij ...	1	9	...	1	...	1	8	1
Assam Tragopan ...	...	...	...	...	...	...	...	...
	5	9	...	5	16	5	12	14
Partridges.								
Assam Black Partridge ...	6	21	13	34	28	251	278	157
Chinese Francolin ...	...	...	...	1	...	3	...	1
Assam Bamboo Partridge	...	7	...	9	11	11	7	...
Hill Partridge ...	...	...	...	...	...	1	...	...
	6	28	13	44	39	266	285	158
Quails.								
Grey Quail ...	...	...	...	...	...	10	17	1
Blue-breasted Quail ...	2	6	13	6	28	68	36	18
Manipur Bush-Quail ...	...	...	2	2	...	18	23	10
Burmese Bustard Quail.	...	1	4	2	...	12	10	18
Little Button Quail ...	.	...	...	1	1	...	...	1
Burmese Button Quail ...	...	...	...	...	...	2	...	1
Quail, unclassified ...	..	...	...	...	...	...	...	...
	2	7	19	11	29	110	86	49
Pigeons.	...	1	...	12	2	15	...	15
Various and Big Game	1	1	2	2	3	5	...	2
Total ...	1461	2624	2918	2748	3938	5765	5019	3399

	1918–19	1919–20	1920–21	1921–22	1922–23	1923–24	1924–25	1925–26
Geese.								
Grey Lag Geese ...	47	37	118	105	89	116	205	179
Bar-headed Geese ...	...	5	3	...	1	5	11	2
White-fronted Geese ...	...	...	1	...	...	...	...	...
	47	42	122	105	90	121	216	181
Ducks.								
Pink-headed Duck ...	...	...	...	...	...	...	...	...
Cotton Teal ...	11	13	25	17	12	40	81	67
Lesser Whistling Teal ...	5	30	25	25	69	95	104	55
Common Sheldrake ...	...	...	...	...	...	...	...	...
Ruddy Sheldrake ...	1	...	2	...	4	2	3	11
Mallard ...	1	...	1	...	...	1	...	...
Spotbill ...	80	63	55	47	55	140	176	243
Eastern Grey Duck ...	...	...	...	...	...	...	...	...
Bronze-capped Teal ...	2	4	...	3	2	3	7	6
Gadwall ...	62	104	204	354	500	548	760	440
Widgeon ...	11	11	9	21	25	40	111	38
Common Teal ...	316	273	181	113	236	376	896	1622
Baikal Teal ...	...	...	...	...	...	...	...	...
Pintail ...	39	39	4	28	94	51	35	183
Garganey Teal ...	91	70	133	132	98	376	560	466
Shoveller ...	39	32	37	44	63	50	136	191
Red-crested Pochard ...	3	9	1	3	12	3	8	...
Common Pochard ...	46	76	45	71	116	153	220	313
White-eyed Pochard ...	42	26	77	79	54	198	209	279
Baer's Pochard ...	2	...	1	...	...	1	5	12
Scaup ...	...	...	...	...	...	...	1	...
Tufted Pochard ...	169	79	296	256	324	365	299	707
Golden-eyed Pochard ...	...	...	...	...	1	...	...	...
Hybrid Duck ...	...	...	...	...	...	1	...	1
Duck and Teal, unclassified ...	77	...	...	...	...	1	...	...
	997	829	1096	1193	1665	2444	3611	4634
Snipes.								
Woodcock ...	8	7	6	7	1	7	15	16
Wood Snipe ...	7	5	6	7	3	4	15	16
Solitary Snipe ...	...	...	...	...	...	...	...	...
Fantail Snipe ...	1052	936	857	600	664	555	1810	2752
Pintail Snipe ...	1284	645	493	808	490	904	1005	1526
Jack Snipe ...	12	49	23	1	8	9	6	33
Painted Snipe ...	19	44	32	21	13	33	113	41
Snipe, unclassified ...	479	2	...	...	...	...	...	23
	2861	1688	1417	1444	1179	1512	2964	4407
Plovers.								
Golden Plover ...	20	67	46	26	34	83	73	22
Other Plover ...	...	...	...	1	...	1	1	...
	20	67	40	27	34	84	74	22

	1918–19	1919–20	1920–21	1921–22	1922–23	1923–24	1924–25	1925–26
Pheasants.								
Burmese Peafowl	...	...	...	...	...	...	...	...
Jungle-fowl	...	23	4	...	4	15	52	41
Black-breasted Kalij	7	9	...	2	13	10	2	3
Assam Tragopan	...	...	...	...	...	...	...	...
	7	32	4	2	17	25	54	44
Partridges.								
Assam Black Partridge	494	271	235	46	105	264	3	573
Chinese Francolin	3	...	3	2	3	...	2	...
Assam Bamboo Partridge	18	3	2	...	4	8	5	121
Hill Partridge	...	3	...	...	4	...	...	81
	515	277	240	48	116	272	550	712
Quails.								
Grey Quail	10	3	11	1	2	3	3	7
Blue-breasted Quail	28	4	6	3	3	9	15	22
Manipur Bush-Quail	42	4	6	5	7	...	8	27
Burmese Bustard Quail	12	1	5	1	3	...	15	15
Little Button Quail	2	2	...	...	...	...	...	7
Burmese Button Quail	...	...	2	2	1	1	...	2
Quail, unclassified	...	...	...	...	...	...	...	3
	94	14	30	12	16	13	41	83
Pigeons.	...	17	...	...	...	7	...	8
Various and Big Game	...	...	3	3	1	5	10	3
Total	4542	2966	2958	2834	3118	4483	7520	10094

	1926–27	1927–28	1928–29	1929–30	1930–31	1931–32	TOTAL
Geese.							
Grey Lag Geese	101	161	140	45	280	174	3331
Bar-headed Geese	1	1	1	2	...	1	54
White-fronted Geese	...	...	...	1	1	...	4
	102	162	141	48	281	175	3389
Ducks.							
Pink-headed Duck	...	...	...	...	...	1	2
Cotton Teal	47	24	37	19	29	9	619
Lesser Whistling Teal	25	24	41	9	94	110	1262
Common Sheldrake	1	...	...	2	...	...	3
Ruddy Sheldrake	7	5	2	3	8	3	89
Mallard	...	...	...	2	...	...	7
Spotbill	250	315	303	480	319	230	3667
Eastern Grey Duck	...	...	...	1	1	...	2
Bronze-capped Teal	4	8	5	6	4	3	63

	1926–27	1927–28	1928–29	1929–30	1930–31	1931–32	TOTAL
Ducks (contd.)							
Gadwall ...	626	361	494	437	475	115	6462
Widgeon ...	29	75	14	48	88	4	639
Common Teal ...	1194	1276	2434	2013	1896	1101	15982
Baikal Teal ...	...	...	...	...	...	...	2
Pintail ...	134	464	402	970	268	216	3491
Garganey Teal ...	422	420	517	388	240	198	5869
Shoveller ...	140	313	362	265	289	177	2591
Red-crested Pochard ...	5	1	1	5	1	...	70
Common Pochard ...	330	293	231	201	298	298	3551
White-eyed Pochard ...	457	396	443	248	353	225	3728
Baer's Pochard ...	2	9	4	6	1	3	51
Scaup ...	...	1	...	...	...	...	2
Tufted Pochard ...	569	908	652	575	462	520	8690
Golden-eyed Pochard ...	...	...	...	...	...	...	1
Hybrid Duck ...	...	...	...	...	1	...	4
Duck and Teal, unclassified ...	35	28	25	34	...	...	418
	4277	4921	5967	5712	4827	3213	57265
Snipes.							
Woodcock ...	17	29	29	18	41	16	236
Wood Snipe ...	5	17	21	25	23	20	213
Solitary Snipe ...	...	...	...	1	1	...	3
Fantail Snipe ...	3457	3602	3028	2356	3168	2385	33559
Pintail Snipe ...	2377	1899	1482	1196	1922	2382	22599
Jack Snipe ...	21	69	57	16	27	22	543
Painted Snipe ...	23	20	29	23	20	31	835
Snipe, unclassified ...	...	...	...	...	...	...	2228
	5900	5636	4646	3635	5202	4856	60216
Plovers.							
Golden Plover ...	42	25	41	25	35	58	853
Other Plover ...	1	...	...	...	...	...	37
	43	25	41	25	35	58	890
Pheasants.							
Burmese Peafowl ...	...	1	...	...	...	...	1
Jungle-fowl ...	34	24	56	33	6	15	352
Black-breasted Kalij ...	15	11	11	8	13	7	132
Assam Tragopan ...	...	1	...	...	...	...	1
	49	37	67	41	19	22	486
Partridges.							
Assam Black Partridge ...	172	397	315	322	335	390	5255
Chinese Francolin ...	1	6	11	1	...	...	48
Assam Bamboo Partridge	74	43	128	97	78	80	708
Hill Partridge ...	2	...	...	...	...	...	10
	249	446	454	420	413	470	6021

	1926–27	1927–28	1928–29	1929–30	1930–31	1931–32	TOTAL
Quails.							
Grey Quail ...	...	5	...	7	...	...	80
Blue-breasted Quail ...	9	10	11	3	15	46	361
Manipur Bush-Quail ...	7	6	14	9	...	...	190
Burmese Bustard Quail	2	5	10	17	4	14	151
Little Button Quail ...	...	...	...	...	1	3	13
Burmese Button Quail ...	1	1	...	...	...	...	18
Quail, unclassified ...	...	...	...	8	...	...	11
	19	27	35	44	20	63	824
Pigeons.	1	...	5	...	...	...	83
Various and Big Game ...	2	5	23	8	2	4	86
Total ...	10642	11259	11379	9933	10799	8861	129260

GEESE.

Manipuri—*kāngngā.*

The Grey Lag Goose (*Anser anser*)[1]—Manipuri, *kāngngā* (not *kāngnai*, as in Baker[2] and Finn[3]).

Baker[4] says of their migration that they 'arrive in India in October, but do not get far . . . east until the end of November; . . . they have all left India, as a rule, by the end of March, yet sometimes stay far later'. The first recorded shot in Manipur was on October 30th., 1911, though reliable shikaris have reported seeing them as early as September 20th (1926). The latest shot was a single bird on the 17th April, 1925, and shikaris have reported them on May 7th (1927). This species has only been shot on one other occasion in April, although stragglers are not infrequently seen in that month. They appear annually in October, but do not attain their full numbers until shortly before Christmas. They begin to move off again about the middle of February, and by the middle of March only a few are left. The stragglers which remain till April are possibly wounded birds. The Manipuri fishermen who live round the Loktak lake have a tradition that one goose and one of each species of duck remain on the lake throughout the year, in attendance on the god of the lake.

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[1] The scientific names are taken from the revised edition of the *Fauna of British India*, and, in the case of animals, from Lyddeker's *The Game Animals of India.*

[2] *The Fauna of British India*, vol. vi, second edition, p. 398.

[3] *Indian Sporting Birds* (1915), p. 64.

[4] *Indian Ducks and their Allies*, first edition (1908), p. 66.

The authorities do not credit this species with occurring in large numbers in eastern India. Baker[1] says 'east of Calcutta it is decidedly rare', but that 'Damant reported it to be common in Manipur'. Damant was right, and the Grey Lag occurs in large numbers, especially on the Loktak lake, where upwards of 90 per cent of the birds shot are killed. I have only once known a bag of any size made on any of the other *bils*. In December and January thousands may be seen on the Loktak. The best year's bag was 465 in 1911-12 (and these figures are incomplete). Good days were:—

11-1-12	176	8 guns
13-1-12	150	8 ,,
23-2-16	144	12 ,,
8-1-31	140	19 ,,
27-12-31	128	16 ,,
20-2-13	123	10 ,,

The largest recorded individual bags are 71, obtained by Colonel M. Goodall, 9th Gurkha Rifles, on January 8th, 1931, and 60, by Captain G. F. X. Bulfield, 6th Gurkha Rifles, on December 27th, 1931. Colonel K. S. Cassels, 8th Gurkha Rifles, and Colonel H. S. Wood, I.M.S., shot 161 in two days, on December 31st, 1897 and January 1st, 1898.

The number of geese visiting the valley has probably decreased of late years, though only to a slight extent. The tendency of bags to diminish is due rather to the increase in the number of gun licenses and to the fact that, owing to motor transport, the Loktak is more shot over than formerly.

Baker[2] credits the Grey Lag with being a 'shy wild bird and difficult to bring to bag'. But in Manipur, where guns are still not too numerous, these geese can often be very obliging on a misty morning, at the first or second shoot of the season on the Loktak. If the sportsman's butt happens to be built on a line of flight where the birds approach the lake from their feeding grounds in the rice fields, or where they cross it from one resting place to another, pairs and skeins will continue to pass, well within shot, until the mist rises and even after. But an injudicious movement at the wrong moment will almost inevitably cause them to swerve off, as they are very keen-sighted. Early in the morning mist they may even be shot on the open water from a boat. Colonel Goodall once shot five geese, on the wing, with one shot.

The Bar-headed Goose (*Anser indicus*)—Manipuri, *kāngshel* (not (*kāngnai*, as in Finn,[3] and in the *Fauna of British India*: *kāngngā* is the name of the Grey Lag, and, from its predominating numbers, the generic term for geese generally).

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[1] Op. cit., p. 65. [2] Op. cit., p. 67. [3] Op. cit., p 60.

Of the Bar-head, Baker[1] is correct in saying that 'in Assam it is comparatively rare, but has been met with in . . . Manipur'. It is a regular visitor, some flocks being seen every year, but never occurs in large numbers like the Grey Lag, as will be evident from the records. It provides only a little more than 1½ per cent of the total bag of geese. The Bar-headed geese reach Manipur later than the Grey Lag and leave earlier, though Baker[2] is not quite correct in saying that 'there is little chance of any being found after the end of February'. A few remain on into March every year, and on March 6th, 1932, I saw two flocks of 23 and 29 respectively fly in and settle on the Loktak lake. The earliest recorded was shot on November 7th, 1929, and the latest on March 20th, 1928. The best year's bag was 11, in 1911-12 and 1924-25. No more than 5 have ever been shot in one day, on three occasions, in 1912, 1915 and 1920.

Baker[3] says of them that they 'are very hard to approach within reasonable distance'. But I have not found them any wilder than Grey Lag on the water, and have twice succeeded in walking up to a flock grazing in the open, sufficiently close to bag some as they rose. In 1920, when shooting snipe on the western shore of the Loktak lake, I saw some 20 birds grazing on a piece of dry land some 150 yards ahead. I walked past them, gradually drawing closer and closer, and though individual birds occasionally raised their heads to look at me, they did not take to flight until I had approached within about 30 yards.

Baker[4] and Finn[5] both refer to a note of Mr. Damant, who was Political Agent in Manipur in 1876, in which he says:—'when they reach the lake, they circle round once or twice, and finally, before settling, each bird tumbles over in the air two or three times, precisely like a tumbler pigeon'. Finn's comment is that 'looping the loop is, somehow, a performance one hardly expects of a goose'. I have seen this species, the Grey Lag Goose and the Spotbill (*Anas pœcilorhyncha pœcilorhyncha*) carry out this evolution on several occasions, and 'looping the loop' does not describe it at all. The bird turns over sideways on to its back in the air, righting itself immediately by turning back again (not making a complete turn). A friend who had served in the R. A. F. once informed me that the technical term for this movement was 'the Immelmann turn'.

The Bar-head appears, as a rule, to favour smaller flocks than the Grey Lag. But in January, 1931, I saw a flock of between 50 and 60 pass over, identifying them by their note, which, as Baker[6] says, is very easily distinguishable from that of the Grey Lag, being more resonant.

The White-fronted Goose (*Anser albifrons albifrons*).

This goose is a rare visitor and has only been recorded four times. One was found in the bag on February 25th., 1916: Colonel

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[1] Op. cit., p. 85.
[2] Op. cit., p. 87.
[3] Op. cit., p. 86.
[4] Op. cit., p. 87.
[5] Op. cit., p. 61.
[6] Op. cit., p. 87.

Goodall shot one on November 7th, 1929, and another on January 18th, 1931, and I shot one on December 27th, 1920. I saw all these birds and can vouch for their identification, which, in the case of the first, was confirmed by the Society. It is possible that this species may occur more frequently and that its resemblance to the Grey Lag may lead to its being overlooked, both on the wing and in a casual examination of the bag.

DUCKS.

Manipuri, *ngānu.*

Manipur, with its large expanse of lakes and swamps in the southern half of the valley, is the home, permanent or temporary, of large numbers of waterfowl. Among the ducks, the Spotbill (*Anas pœcilorhyncha pœcilorhyncha*), the Lesser Whistling Teal (*Dendrocygna javanica*) and the Cotton Teal (*Nettopus coromandelianus*) are resident and breed, while all the common migratory species of ducks are found in the cold weather, in large numbers. Migration begins in September, the advance guard occasionally appearing as early as August. But the main body does not arrive until November, and it is not before the second week of that month that duck shooting begins in earnest. Early in the season the duck frequent the small shallow lakes and marshes, moving on, as these dry up, to the two large lakes, Loktak in the south-west, and Ikop in the south-east of the valley. The return migration varies from season to season, but can be said to begin towards the end of February, and by the middle of April only stragglers remain.

The best bag of duck recorded is that of 1928-29, when 5,967 were shot. Good days were:—

27-12-31	... 654	18 guns
6-12-25	... 611	7 ,,
27-12-25	... 588	19 ,,
8-1-31	... 497	19 ,,
2-12-28	... 472	5 ,,
14-12-30	... 471	6 ,,
27-12-22	... 427	13 ,,
16-12-26	... 411	7 ,,
18-12-27	... 409	7 ,,
27-12-29	... 403	15 ,,
16-12-28	... 403	5 ,,
20-12-25	... 401	7 ,,

(These figures are for duck only, and exclude geese, snipe and other species.)

Good individual bags were:—

Colonel M. Goodall ...	14-12-30	226
	18-12-27	219
Captain W. R. B. Williams, 7th. Gurkha Rifles,	6-12-25	211

The following table shows the total number of each species shot in the period 1910-11 to 1931-32, and the percentage it forms of the total bag of duck:—

Common Teal ...	15,982	28·12 per cent
Tufted Pochard ...	8,690	15·29 ,,
Gadwall ...	6,462	11·37 ,,
Garganey Teal ...	5,869	10·32 ,,
White-eyed Pochard ...	3,728	6·56 ,,
Spotbill ...	3,667	6·45 ,,
Common Pochard ...	3,551	6·26 ,,
Pintail ...	3,491	6·14 ,,
Shoveller ...	2,591	4·56 ,,
Whistling Teal ...	1,269	2·23 ,,
Widgeon ...	639	1·12 ,,
Cotton Teal ...	612	1·08 ,,
Ruddy Sheldrake ...	89	0·16 ,,
Red-crested Pochard ...	70	0·12 ,,
Bronze-capped Teal ...	63	0·11 ,,
Eastern White-eyed Pochard ...	51	0·09 ,,
Mallard ...	7	0·02 ,,
Common Sheldrake ...	3	
Baikal Teal ...	2	
Scaup Duck ...	2	
Eastern Grey Duck ...	2	
Pink-headed Duck ...	1	
Golden-eye ...	1	
Hybrids ...	4	

The Nukhta or Comb-Duck (*Sarkidiornis melanotus*).

This species is a rare visitor. Two were shot in 1911-12 by Major A. H. D. Barron, 20th. Burma Rifles. I once saw a small flock on the Loktak lake. My shikari, who is a careful observer and skilful at the identification of game birds, has reported the presence of Nukhta on various *bils* in the autumn of 1924, 1925, 1927, 1928 and 1930.

The White-winged Wood-Duck (*Asarcornis scutulatus*).

Very rare in Manipur, though frequently seen in the Nambar Forest of the Assam Valley, where Baker[1] says rightly that it 'is found in some numbers', and occasionally in the Kabaw Valley of Burma, to the north and south-east of Manipur respectively. One was shot and brought in to me on April 30th, 1925. From the description given to me, an officer touring in the eastern hills appears to have seen one on July 15th, 1925. A large duck, resembling this species in description, was reported to me on a chain of *bils* south-east of Imphal in July, 1931, and a pair in June, 1932. I myself, touring in the north-eastern hills, saw three in a small tributary of the Iril river on July 24th, 1913, at about

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[1] Op. cit., p. 35.

3,000 ft. The local Kukis informed me that this stream had been blocked by a landslide in its upper reaches and that a small lake had been formed, on which there were duck. They refused to accompany me, for fear of evil spirits, as a man who had shot some of the duck had died. On arrival at the lake—quite a small sheet of water, about 80 yards long by 30 yards broad, overhung by a wooded bluff,—I found three wood-duck swimming about on it.

Baker[1] refers to the call of this bird as 'goose-like'. But it is, in reality, far clearer and more musical than the note of either the Grey Lag or the Bar-headed Goose.

Finn[2] presumes that the Wood-duck is 'fairly good eating'. My experience of it in the Assam valley is that the flesh is extremely coarse, resembling that of the Brahminy in flavour and texture. However, it is a question of degree and to one accustomed to a diet of Indian fowl and goat even the Whistler and the Brahminy come as a welcome change, when other ducks are not available.

The Pink-headed Duck (*Rhodonessa caryophyllacea*).

This bird, as Hume[3] says, is 'very scarce in Manipur'. Of late years, Mr. W. A. Cosgrave, I.C.S., shot one in November, 1908, and I shot the male out of a pair on October 23rd., 1910. Till this year I never saw another, though they have been reported very occasionally by guns and shikaris. It is very possible that they may have mistaken Red-crested Pochards for this bird, as it is not difficult to confuse them when on the wing. But on June 14th., 1932, my shikaris reported two strange duck with some Spotbill and Whistling Teal on a *bil* 9 miles south of Imphal. I went out on the 15th. and put up one of the birds, with some Whistlers. It flew into the sun, and as I was unable to recognise it, I shot it and found it was a Pink-headed drake. I did not see the duck.

There seems to be no doubt that this bird breeds further east than it is given credit for doing. In Nowgong (Assam) I saw flocks on several occasions in March, during the years 1921 to 1923. On May 18th, 1922, when out after elephant in the long *ekra* grass by the Brahmaputra, I saw two pairs in a small *bil* in the jungle. They were very tame and I watched them for some time. These birds and the Manipur pair must have been breeding.

The Cotton Teal (*Nettapus coromandelianus*)—Manipuri, *pegdek*, *ngānu pegdek*. The name is onomatopoeic being derived from the bird's call.

This little duck is resident in Manipur, where it breeds, though, as Baker[4] says, it is 'semi-migratory'. It is found in considerable numbers in the rains, is plentiful on the *bils* at the beginning and end of the cold weather, and almost disappears between the middle of November and the middle of February. It is astonishing that such a low-flying bird can cross the high mountain ranges which surround the Manipur valley on every side, but there seems to be little doubt that it does. Indeed, Colonel Cassels records having shot one on May 23rd, 1896, on a tarn on Koubru, the mountain at the north-west extremity of the valley, at an altitude of 7,800 ft.

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[1] Op. cit., p. 36.

[2] Op. cit., p. 56.

[3] *Stray Feathers*, vol. xi.

[4] Op. cit., p. 49.

The Cotton Teal is not much shot, owing to its low flight. The best year's bag was 81 in 1924-25.

Finn[1] notes that the Cotton Teal 'swim and dive well'. This is very true. A wounded bird is very difficult to retrieve, diving when approached and swimming to the nearest patch of water weed, where it usually hides with only its head above water.

Baker[2] suggests that this bird is inferior as a table bird. But though it certainly does not rank with such aristocrats of the table as the Mallard, Spotbill, Pintail, Gadwall, and Common and Garganey Teals, I consider it definitely superior to the pochards. 'Raoul'[3] classes them as 'excellent eating . . . at the proper season' (January to March).

The Lesser or Common Whistling Teal (*Dendrocygna javanica*) —Manipuri, *tingi*.

This is another resident species, which breeds in Manipur and emigrates early in the cold weather, though a certain number remain behind. But the migration of this species and of the Cotton Teal from Manipur is not, as Baker[4] suggests with regard to other localities, due to want of water. In the swamps in the south of the valley there are a number of *bils* which never dry up. The periods of its migration coincide with those of the Cotton Teal.

The Whistling Teal is not very much shot, partly because its tameness and slow flight render it unworthy of the expenditure of powder and shot, when other more sporting duck are to be had in plenty, and partly owing to its deficiencies as a table bird. As Finn[5] remarks, its 'flesh is poor, but will do for soup'. But occasionally it finds its way into the bag in fairly considerable numbers, when other ducks are scarce or when the guns include inexperienced sportsmen or those who like a satisfactory return for the number of cartridges used.

The Whistler is, as Baker[6] remarks, 'a horrible nuisance'. Vociferous flocks have a habit of flying round and round over one's butt, swerving off at the least movement and diverting their more worthy cousins from the vicinity. The exasperation caused in the inmate of the butt has proved fatal to many a Whistler, shot in an endeavour to drive away the noisy flock.

I have never seen the Whistling Teal nesting in a tree. One or two pairs breed every year on a small island in a large tank in the Residency garden. On this island, which is covered with tall reeds, there are several trees, but the birds appear to prefer to build their nests among the reeds, as I have never seen them perch on the trees. I once saw a duck with nine ducklings on the tank. During the hot weather and rains a number of Whistling Teal rest on the tank during the day. They spend much of their time sitting in a row on the bank, and in rainy weather they wander about the lawn as far as 50 yards from the water, feeding. I have noticed tame ducks doing the same when it is raining.

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[1] Op. cit., p. 48.

[2] Op. cit., p. 50.

[3] *Small Game Shooting in Bengal*, p. 162.

[4] Op. cit., pp. 49, 100.

[5] Op. cit., p. 57.

[6] Op. cit., p. 101.

The Large Whistling Teal (*Dendrocygna fulva*).

Baker[1] records this species as being uncommon in Assam, and says, in the *Fauna of British India*, that it 'extends through Manipur into Northern Burma'. It is actually very rare in the State, and I do not know of its having been shot. I saw a pair on September 6th, 1925, and a single bird on October 14th, 1929. My shikari reported having seen pairs on December 4th, 1926, and October 15th, 1927. I know of no other instances of its having been seen.

The Sheldrake (*Tadorna tadorna*).

A rare visitor. One was shot by a shikari in 1910, a single male was bagged on April 3rd, 1927, and a pair on January 2nd, 1930. I saw a flock of six on October 27th, 1918, and a single bird on February 14th, 1932. My shikari reported a few in the autumn of 1924, 1925, 1928 and 1929.

The Ruddy Sheldrake or Brahminy Duck (*Casarca ferruginea*)—Manipuri, *thānggong*.

This duck is a regular visitor, but not in large numbers, as might be expected from the fact that the rivers in the Manipur valley suffer from the same disadvantage, from the view of the Brahminy, as those ascribed to the rivers of Cachar and East Sylhet by Baker,[2] being 'muddy and wanting in suitable sandy banks'. The numbers in the game records, however, are no indication of their rarity, as they are not often shot. The earliest record is on November 2nd (1924), and the latest on March 18th (1916), though one was seen on May 4th, 1927. This bird is far less wary in Manipur than I have found it elsewhere.

The Mallard (*Anas platyrhyncha*).

Baker,[3] quoting Colonel Wood, says, 'the Mallard is extremely rare in Manipur'. It is certainly very uncommon, but a few are seen in most years. I have seen occasional birds in every season since 1924. Only seven have been brought to bag since 1910, however, the earliest recorded being on November 4th (1923) and the latest on March 16th (1913).

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[1] Op. cit., p. 94.

[2] Op. cit., p. 116.

[3] Op. cit., p. 126.

The Spotbill or Grey Duck (*Anas pœcilorhyncha pœcilorhyncha*), —Manipuri, *pirel* or *ngānu pirel,* not *kārā,* as in Finn,[1] Baker[2] and Wright and Dewar[3]: *khārā* is the Manipuri name for the Shoveller.

The Spotbill is very common in Manipur, though not so in comparison with the Common and Garganey Teals, the Pintail, the Gadwall, and the Common, White-eyed and Tufted Pochards. In the bag, however, it comes sixth in point of numbers, with a percentage of 6.45 per cent, between the White-eyed and the Common Pochards. Its comparatively high position is due to the fact that it is less wary than the above-mentioned species. It resides and breeds in the swamps in the south of the valley. There is nothing to show whether it emigrates during the cold weather, like the other resident duck, though, as a general rule, far more are seen at the beginning of the shooting season, in November and December, than later in the cold weather. This is possibly due to the birds pairing early and retiring to the reed-covered bogs and marshes for the purpose of breeding. Colonel Wood[4] says that in Manipur 'the birds generally pair about the beginning of April'. But this is certainly wrong: they may be seen in pairs in February and March, and even much earlier. My personal impression is that they may pair for life. The fact that they are sometimes seen in flocks does not disprove this supposition, as the flock may consist of a family, or of a number of pairs or families. By April most of the pairs are beginning to lay.

The best bag of Spotbill recorded is 480, in 1929-30. Good days have been:—

2-1-28	... 52
28-3-26	... 40
5-11-11	... 38

Oates[5] quotes Hume as saying that the Spotbill is 'excessively abundant and very tame on the Loktak lake'. But Baker[6] is more correct in saying that they prefer *bils* surrounded by grass and are rare on the Loktak (except at the northern end). In the spring Spotbills are often found on the Manipur river, above and below where it enters the hills at the southern end of the valley. As regards altitude, I have met with it in the valley of the Nungshangkhong, in the eastern hills, at a height of 3,750 ft.

The account of the habits and characteristics of this species given by Baker[7] is generally correct. But I have always found that the Spotbill carries plenty of lead, unless hit well forward, and is by no means easy to bring down. 'Raoul'[8] confirms this opinion, saying that they are 'hard to kill, and . . . will carry away a lot of shot'. As a diver, I do not consider it ranks with real experts, such as the Pochards and Teal, or even the Gadwall. It never fails to make for the nearest available reeds or floating matted grass, where, as Finn[1] says, it 'hides most cunningly in any available cover', like the Grey Lag goose. Its habit, noted by Baker,[2] of returning (like the Brahminy) to look for its dead mate is very characteristic, and the fact that it does so at all times in the cold weather tends to support the theory that these birds may pair for life. In Manipur none of the large duck surpass the Spotbill as a table bird—possibly because its nourishment never suffers the setback of the lean times of migration.

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[1] Op. cit., p. 6.

[2] *The Fauna of British India,* vol. vi, p. 421.

[3] *The Ducks of India* (1925), p. 66.

[4] Baker, *Indian Ducks and their Allies,* p. 137.

[5] *Game Birds of India* (1898), part ii, p. 153.

[6] Op. cit., p. 135.

[7] Op. cit., p. 136.

[8] Op. cit., p. 136.

The Eastern Grey Duck (*Anas pœcilorhyncha zonorhyncha*). Manipuri, *pirel*, *nganu pirel*.

This species, easily distinguishable from the preceding one by the blue speculum, is very rare in Manipur. Only two have been recorded, one shot by Colonel Goodall on February 6th, 1930, and the other by me on January 18th, 1931. The shikaris picked out the birds immediately as belonging to a different species, before the bags were examined, on account of the yellowish buff colour of the abdomen and under tail coverts.

The Burmese Grey Duck (*Anas pœcilorhyncha haringtoni*).

Of 3,667 Grey Duck recorded since 1910, 2,391 have passed through my hands, and although I have been on the lookout for this species, which should at least straggle into Manipur (the Manipur valley is only 20 miles distant in an air line from the Burma border, and 36 miles from the Chindwin river), I cannot say with any certainty that it does or does not occur. It seems almost impossible that it should not do so, if the Grey Duck are migratory. For, writing in 1908 of the Birds of the Chindwin, Hopwood[3] records only one specimen of *pœcilorhyncha*, whereas of *haringtoni* he remarks that it is 'common and breeds . . . obtained specimens intermediate between this and the foregoing species'. While not presuming to fly in the face of the authorities who have accorded their recognition to *haringtoni* as a separate subspecies, I maintain that, to the amateur field naturalist, the distinction indicated in the '*Fauna of British India*' does not afford sufficient material for certain identification. The description given is:—'differs from the Indian Grey Duck in having no red spots on the base of the bill, or only very faint traces of them; the speculum is green as in that bird, but the underparts are less spotted and generally paler'. With regard to *A. p. pœcilorhyncha*, the same volume says 'young birds have no red spots at the base of the bill . . . the general plumage is rather lighter and the spots on the lower plumage sparse or obsolete'. Moreover, in birds which, from the presence of well-developed spots at the base of the bill, can be identified with certainty as *a. p. pœcilorhyncha* the variation in the colour and degree of the spotting of the underparts is so very considerable that this characteristic cannot safely be adopted as a test. It seems, therefore, that the differentiation of the two subspecies is a matter which can only be undertaken with any certainty by scientific ornithologists, with a large series of Grey Duck at their disposal, or sufficient knowledge to enable them to differentiate between young and old birds. There is also, of course, a difference in the size of the two subspecies, *a. p. haringtoni* being apparently much the smaller of the two. But here again the size of individuals admittedly of the same species differs so considerably that this affords no certain criterion.

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[1] Op. cit., p. 5.

[2] Op. cit., p. 139.

[3] *Journal of the Bombay Natural History Society*, vol. xviii, 2, p. 433.

(*To be continued*).

THE CIVET-CATS OF ASIA.

BY

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(*With 4 text-figures*).

Under this popular term are included the species which in Blanford's *Mammalia of British India* and other treatises on the oriental faunas are referred to as the genera *Viverra* and *Viverricula*. To these I have added a third genus based upon two comparatively imperfectly known species. These three genera, with the African Civet Cat (*Civettictis*), constitute a compact little group of the family *Viverridae* and may be classed together as the subfamily *Viverrinae* which differs from the Palm Civets (*Paradoxurus* and others) and the Water Civets (*Cynogale*) in the more elaborate structure of their scent-pouches and the formation of the feet. The scent-pouches are closed, but openable, receptacles for the storage of the secretion and are situated between the scrotum and the orifice of the penis in the male and between the anus and the vulva in the female in which they are wholly perinaeal in position and do not pass in front of the vulva as in the Palm Civet (*Paradoxurus*) and the Binturong (*Arctictis*). The feet are essentially adapted for life on the ground and bear a close superficial resemblance to the digitigrade feet of the Cats particularly in the reduction in size of the carpal pad of the forefoot and the complete, or almost complete, suppression of the metatarsal pads of the hind foot which is entirely, or very nearly so, covered with hair from the hock to the plantar pad.

The principal external and cranial differences between the three Asiatic genera are briefly set forth in the following analytical 'keys':—

External Characters.

a. No dorsal crest; forehead narrow between the anterior edges of the ears which are set comparatively close together; feet as in *Moschothera*, with no claw-sheaths ... *Viverricula*.

a^1. A dorsal crest of hair at least from the shoulders; forehead wide between the anterior edges of the ears.

  b. Toes without skin-lobes protecting the claws; feet comparatively naked beneath between the pads ... ... *Moschothera*.

  b^1. At least the 3rd. and 4th. toes of the forefoot with well developed sheaths protecting the claws; feet thickly hairy between the pads ... ... *Viverra*.

Cranial Characters.

a. Auditory bullæ long, considerably exceeding the width across the occipital condyles; posterior area of cranium strongly compressed above; muzzle short and weak ... *Viverricula.*

a[1]. Auditory bullæ comparatively short, not exceeding the width across the occipital condyles; cranium only moderately compressed in its upper portion behind; muzzle long and stout ... ...

b. Postorbital processes almost or quite suppressed; their position behind the middle point of the total length of the skull *Moschothera.*

b[1]. Postorbital processes present and in front of the middle point of the total length of the skull ... ... *Viverra.*

Genus: Viverra, Linn.

Viverra, Linn., *Syst. Nat.* ed. 10, p. 44, 1758.

Type of the genus: *V. zibetha*, Linn.

Until comparatively recently the name *Viverra* was used in a comprehensive sense for the African Civet (*civetta*) and the four oriental Civets (*zibetha, megaspila, civettina* and *tangalunga*). But in 1915 (*Proc. Zool. Soc.* 1915, pp. 131-149) I dismembered the African Civet from *Viverra* on the evidence supplied by some well marked differences between its feet and those of *zibetha*, the type of the genus *Viverra*, and restricted to *Viverra* the four oriental species. At that time I had no examples of *megaspila, civettina* or *tangalunga* for examination. Subsequently the chance of examining a fresh specimen of *tangalunga* at the Zoological Society's Gardens presented itself and I found that in all essentials the species resembles *zibetha*. But I recently discovered upon relaxing the feet of dried skins of *megaspila* and *civettina* that these species differ in the structure of their feet from *zibetha* and *tangalunga* and more closely resemble in that respect the African Civet (*Civettictis*)[1]. In this paper, therefore, I restrict the name *Viverra* to *zibetha* and *tangalunga*, separating *civettina* and *megaspila* from them as *Moschothera*.

Viverra may be distinguished from the other genera of *Viverrinae* mentioned above by the presence on the 3rd and 4th digits of the forefoot of well developed lobes of hairy skin which constitute protective sheaths for the claws exactly as in the Cats (*Felidæ*). The third digit has two lobes, an inner larger and an outer smaller; the fourth has only an outer lobe. A glance, however, at the figure of the foot (Text-fig. 1, A, p. 425) will show that when the digits are closed these lobes protect the points of the claws not only of the 3rd and 4th but of the 2nd and 5th digits as well. The digits are fully webbed, as in most Carnivora, and the area between the large plantar pad and the digital pads is thickly covered with hair except for a narrow strip of naked skin along the under side of each digit. In the setting of the ears and the presence of the dorsal crest, the genus resembles its two allies *Moschothera* and *Civettictis*, the three differing in those respects from *Viverricula*.

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[1] Since this Civet is outside the limits of this paper, I may briefly dismiss it by saying that it differs generically from *megaspila* and *civettina* in some features connected with the feet and skull.

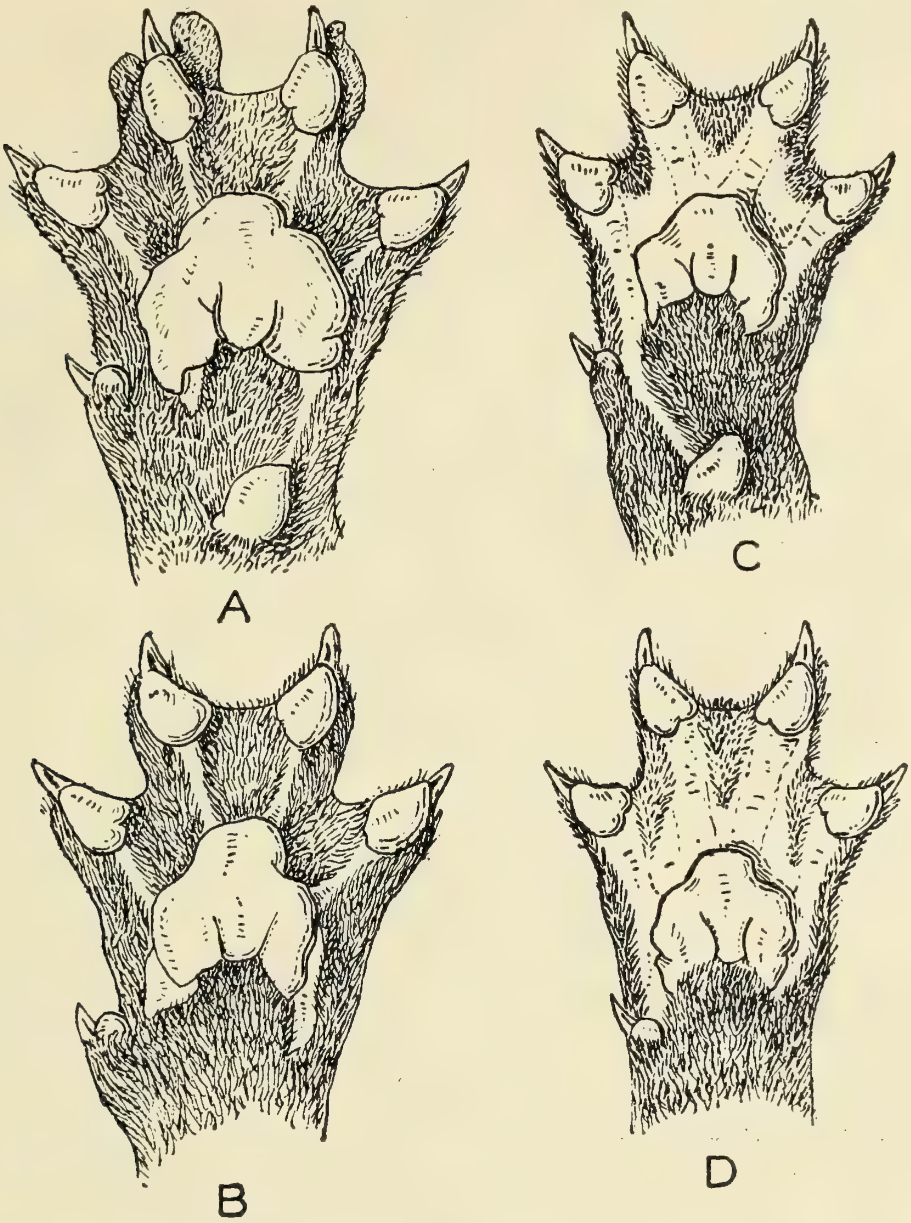

Fig. 1.—A. Lower side of left fore paw of *Viverra zibetha*. B. The same of the left hind paw. C. The same of left fore paw of *Viverricula indica*. The sole is more hairy in some specimens. D. The same of left hind paw.
(Copied from *Proc. Zool. Soc.* 1915, pp. 131-149).

The distinguishing cranial characters of *Viverra* as compared with its oriental allies, are briefly set forth in the table given above. The postorbital processes (Text-fig. 2, E, p. 439) of the frontal bone are well developed in the adult and the distance between them and the tip of the muzzle is less than the distance between them and the edge of the occipital crest behind, the facial portion of the skull being shorter in comparison with the cranial portion than in *Moschothera*.

Attention may here be drawn to two features in the skull of *V. zibetha* which might be considered of systematic importance. The size of the auditory bulla varies considerably in specimens from the same locality, as shown in the figures (Text-fig. 2, A, B, p. 439) of this structure in two adult examples of typical *V. zibetha* from Gorkha in Nepal. In one the bulla, measured obliquely from the outer edge of the paroccipital to its apex, is only 13 mm., and its apex, comparatively slightly inflated, does not reach as far as the anterior end of the auditory orifice. In the other the bulla, similarly measured, is 17 mm. and its strongly inflated apex reaches as far as the anterior end of the auditory orifice. All intermediates between these two conditions exist in Nepalese skulls.

The mesopterygoid fossa is similarly variable independently of race. In an example of *V. z. ashtoni* from Chin Kiang, on the Yang-tse, it is wide, with arcuate sides and evenly concave anterior border. In others from Chin Kiang and Foochow it is narrower, with nearly parallel sides and irregularly truncated anterior border, with a shallow median notch. In other cases the truncated anterior border may have a median spike instead of a notch (Text-fig. 2, C, D, p. 439).

The two well defined species of this genus may be distinguished superficially as follows:—

a. Size comparatively large; pattern on flanks, when distinct, variable, mottled, brindled or 'mackerel'; white bands on tail forming complete rings ... ... *zibetha.*

b. Size comparatively small; pattern on flanks consisting of small, close-set solid spots; white bands on tail not passing over its summit, forming incomplete rings ... *tangalunga.*

VIVERRA ZIBETHA, Linn.

The principal references to the literature of this species will be found under the headings of the subspecies or local races by which it is represented; and no description of it is required beyond that given above.

Its distribution is from Southern China and Northern India to the Malay Peninsula and Siam where it overlaps the range of *Moschothera megaspila.*[1]

As may be seen from the measurements cited below, the males and females differ very little in size. This applies to the skull and teeth as well as to the body.

With regard to the variations exhibited by this species, I may anticipate what follows by briefly stating that in the more northern races there is great seasonal difference in the length and luxuriance of the coat. In the winter it is long and thick; in the summer short and sleek. This is accompanied by a corresponding difference in the conspicuousness of the pattern, which is strongly pronounced in summer skins, indistinct or even obliterated in winter skins.

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[1] This fact alone is strong presumptive evidence of the generic difference here claimed between the two species. Two species of the same genus seldom occur in the same district unless their habits or habitats are different.

The ground-colour varies individually, even irrespective of season, from tawny to clear almost silvery grey. In tawny skins the pattern is naturally less emphasised than in grey skins in which the contrast is greater. There appears to be but one moult which probably varies in time to a certain extent but takes place in about May, June or July.

THE LARGE CIVET CAT FROM CHINA.

Viverra zibetha ashtoni, Swinh.

Viverra ashtoni, Swinhoe, *Proc. Zool. Soc.* 1864, p. 379, with text-fig.

Viverra filchneri, Matschie, *Chin. Saug. in Filchner Exped.*, p. 192, 1908.

Viverra zibetha ashtoni and *filchneri*, A. B. Howell, *Proc. U.S. Nat. Mus.*, 75, p. 30, 1929.

Viverra zibetha, G. M. Allen, *Amer. Mus. Novit.*, No. 359, pp. 1-2, 1929.

Locality of the type of ashtoni: Suykaon on the Min River, Foochow.

Locality of type of filchneri: Hinganfu, South-eastern Shensi.

Distribution: Southern China as far north as Shensi.

From a few scattered localities in China the British Museum has only a comparatively small number of unmeasured, mostly undated skins which, in agreement with G. M. Allen's opinion regarding the skins in the American Museum of Natural History, New York, I regard as representing a single race. Allen, however, having no material from India wherewith to compare his Chinese specimens and perceiving that all the characters hitherto used for distinguishing the races of this Civet, namely the tawny or grey hue and the distinctness or indistinctness of the pattern, are individually variable in Chinese skins, identified the latter as *V. zibetha*, Linn. No doubt Chinese specimens intergrade absolutely with those found farther south, but I regard them as belonging to a distinct local race on account of the greater length and luxuriance of the winter coat, the tail being correspondingly more bushy.

Variation in the length of the pelage, no doubt seasonal, is shown by the following specimens:—

Foochow in Fokien, January, crest hairs 90 mm., flank hairs 48 mm.

Han Chung in Shensi (no date), crest hairs 88 mm., flank hairs 42 mm.

Sui Ling (no date), crest hairs 80 mm., flank hairs 42 mm.

Tingchou, December, crest hairs 73 mm., flank hairs 46 mm.

Amoy in Fokien (no date), crest hairs 50 mm., flank hairs 25 mm.

The two specimens exhibiting the greatest variation in the coat, namely the examples from Foochow and Amoy, were collected by Swinhoe in Fokien; and since the type of *ashtoni* was also from Foochow in that state, there can be no doubt about the identification. In the Foochow specimen the coat is very long and full, but would probably have been still longer if the animal had been killed in March. The general colour is dark grey over the shoulders and there is some white mottling on the flanks, but the hind body is mostly bright tawny owing to the very obscure pattern being that tint; there is no tawny on the belly. In the undated specimen from Amoy the coat is short and sleek, no doubt representing the summer pelage; the general colour is greyish, without distinct tawny wash, and the pattern is brown and conspicuous from the shoulders backwards, consisting mostly of irregular transverse often fused bands in front and of blotches behind; the pale band defining the black dorsal crest is very sharp. The tint and pattern of this specimen are almost exactly as in the type of *V. zibetha picta* described below.

The example from Tingchou, a locality I cannot trace, was also collected by Swinhoe. The coat is full as in the January skin from Foochow; but the crest is much shorter; it would no doubt have increased in length in another three months. The pattern too is more distinct and olive brown, the flanks being mottled with grey without tawny wash.

The example from Sui Ling (*W. A. Maw*) is hardly distinguishable in colour and pattern from the skin from Tingchou. A specimen ticketed 'China' which perhaps came from Canton since it was collected by J. R. Reeves, is beginning to show the moult. The coat is a little shorter than in the Foochow and Tingchou specimens; it exhibits a faint tawny wash but the pattern is indefinite, at most represented by obscure brown mottling.

The skin from Shensi, collected 40 miles north of Han Chung by M. P. Anderson, is very like the long-coated skins described above, but the pattern is even less distinct. The skin is of particular interest because the type of *filchneri* also came from Shensi; but since Anderson's example practically only differs from Swinhoe's example from Foochow, which is a topotype of *ashtoni*, in the absence of the bright tawny hue of the vestigial pattern, the conclusion that *filchneri* is a synonym of *ashtoni*[1] is justified. The type of *filchneri*, exhibiting a distinct pattern, was no doubt in summer pelage.

The difference in the length of the winter coat between these Chinese skins and skins assigned to typical *V. zibetha zibetha* from Nepal, Sikhim and Bengal may be seen by the particulars recorded below under the latter subspecies.

THE LARGE CIVET CAT FROM NEPAL, SIKHIM AND NORTH BENGAL.

Viverra zibetha zibetha, Linn.

Viverra zibetha, Linn., *Syst. Nat.*, ed. 10, p. 44, 1758.

Viverra undulata, Gray, *Spic. Zool.*, p. 9, pl. 8, 1830.

Viverra orientalis or *melanurus*, Hodgson, *Calc. Journ. Nat. Hist.*, ii, pp. 47-50, 1842.

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[1] The type of *ashtoni* is not in the British Museum. Swinhoe's illustration of it shows clearly that the animal was in winter coat, not in summer coat as Howell supposed. The tail was imperfect, as indicated by the white tip, a feature which seems to have deluded Matschie.

Viverra undulatus, *id. tom. cit.*, p. 50.

Viverra civettoides, *id. tom. cit.*, p. 62 (substitute for *undulatus*).

Viverra melanura, *orientalis* and *civettoides*, Gray, *Cat. Mamm. Hodgson's Coll.*, p. 7, 1847.

Locality of type of *zibetha*: Bengal (Thomas, *Proc. Zool. Soc.*, 1911, p.).

Locality of type of undulata, Gray: Nepal.

Locality of type of *orientalis* or *melanurus*: Nepal.

Locality of type of *civettoides*: Darjiling.

Distribution: Bengal, Bhutan, Kamrup, Sikhim, Nepal.

Note on the synonymy: Linnæus's description of *Viverra zibetha* suggests that the name may have been given to more than one species; but I accept the traditional application of it to the 'Large Indian Civet' and Thomas's decision that the type came from Bengal. Gray gave the name *undulata* to a headless, footless skin obtained by Hardwicke in Nepal and exhibiting a very distinct pattern of close-set, narrow, wavy stripes of the 'mackerel' type. This skin is not in the British Museum; but one of Hodgson's specimens from Nepal, a young example, very closely resembles it.

Two more of Hodgson's specimens were selected as 'cotypes and lectotypes' of Hodgson's *melanurus*[1] by Thomas. They are very much alike, both having the coat long and thick. One is greyish tawny with scarcely a trace of pattern on the flanks; the hairs of the crest over the loins measure 64 mm., those of the flanks 36 mm. The other is a little more silvery and less tawny, with the flanks more distinctly mottled. A third has the coat decidedly shorter, a good deal more silvery grey in the pelage and the pattern on the flanks forming definite transverse bands suggesting confluence of rosettes.

Hodgson originally identified as *undulata* Gray an example from Darjiling which differed from his *melanurus* in its more distinct pattern. But change of opinion on this point, induced him to introduce *civettoides* for his Darjiling example. The specimen in the British Museum identified by Thomas as the type of *civettoides* is labelled Nepal.[2] It has the coat much shorter than in the cotypes of *melanurus*, the crest-hairs being 45 mm. and the flank-hairs 25 mm.; and the pattern is quite distinct, stronger even than in the third specimen of Hodgson's mentioned above. The general tint, however, is a browner tawny than in the darker of the two cotypes of *melanurus*.

A casual glance at Hodgson's specimens suggests that they merely represent individual and seasonal variations of the same race. This is completely borne out by the magnificent series of dated skins obtained for 'The Mammal Survey' at different months of the year in Nepal, Sikhim and Bhutan Duars by N. A. Baptista. It is only possible, however, to refer to the most interesting specimens.

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[1] Hodgson's ascription of the name *orientalis* to this Nepalese *Viverra* invalidates Matschie's use of it for the East African Civet Cat, which he called *Viverra civetta orientalis*. I propose to substitute *matschiei* for this race.

[2] It does not necessarily follow from this that the specimen is not the type because some of Hodgson's Sikhim animals were wrongly entered as coming from Nepal.

Nepal. A series of a dozen skins in winter pelage obtained in the Gorkha district between November 24 and March 15.

Coat long and thick, measuring as follows:—

Skin from Bokarlang, November 24, crest-hairs 63 mm., flank-hairs 38 mm.

Skin from Boitarg, December 22, crest-hairs 68 mm., flank-hairs 38 mm.

Skin from Syartang, February 7, crest-hairs 73 mm., flank-hairs 36 mm.

These data suggest increase in the length of the crest through the winter months, the example from Bokarlang being almost identical with Hodgson's cotype of *melanurus*.

Colour very variable. Of two examples, for instance, from Syartang, Feb. 7 and 10, one has a faint tawny wash as in a skin from Bokarlang, Nov. 24, whereas the other exhibits an ochreous tawny wash as in a skin from Khoplang, Feb. 21, which is decidedly richer tinted than in a second from the same locality, Feb. 22. Pattern on flanks always indistinct, but individually variable to a certain extent. In an example, ticketed Gorkha, 1,000 ft., March 15, it is practically obsolete.

Moult. In addition to the winter skins above described, two were procured showing the moult. One from Chalna Kel, May 7, has no appreciable tawny wash and the long, silver-tipped hairs have disappeared to a great extent on the hind quarters, revealing a short coat with a distinct pattern of blotches. The other from Banso Bahari, May 23, is like the last but has the moult still more advanced, the long hairs being absent in patches on the hind quarters, flanks and low down on the shoulders, showing a short coat with distinct pattern.

Sikhim. A series of over a dozen skins, mostly from the Darjiling district, exhibit the seasonal changes even better than those from Nepal. Variations in the coat measurements are as follows:—

Skin from Batasia Tonglu, 6,000 ft., February 27, crest 69 mm., flanks 38 mm.

Skin from Rongli, 2,700 ft., February 27, crest 63 mm., flanks 36 mm.

Skin from Narbong, 2,000 ft., March 9, crest 60 mm., flanks 38 mm.

Skin from Gopaldara, 4,720 ft., April 4, crest 64 mm., flanks 33 mm.

Skin from Pashok, 3,500 ft., July 5, crest 38 mm., flanks 20 mm.

The example from Pashok, a female, has the pattern strongly pronounced, consisting of blackish transverse stripes on the dark grey fore quarters and of loops and rosettes on the tawny-washed hind quarters; but in a male, with a similarly short coat, with the same date and locality, the pattern is brown and consequently less conspicuous against the ground colour. A pair from Nimbong, July 19, is very like it. In these specimens from Pashok and

Nimbong the moult appears to be just completed; but in a skin from Sungma, 4,500 ft., July 18, some of the long, grey-tipped hairs of the winter coat are still in place. In a skin from Gopaldara, 4,700 ft., June 3, the moult is in full force, the coat is bad and the pattern mottled brown.

Of the specimens with the long, full winter coat, the one from Batasia Tonglu exhibits a conspicuous tawny wash and a traceable pattern of indistinct brown mottling and brindling on the hinder part of the body. Four from Narbong are very similar in tint and pattern; but the skin from Gopaldara is grey without appreciable tawny wash and the pattern is fainter.

I cannot distinguish these Sikkim specimens from the Nepalese.

Bhutan Duars. A series of skins collected at Hasimara, 500 ft. to 600 ft., and at Bharnabari, 600 ft., between October 22 and February 22, exhibit the following progressive increase in the length of the coat:—

Hasimara, October 22, crest 40 mm., flanks 20 mm.
Hasimara, November 11, crest 50 mm., flanks 32 mm.
Hasimara, December 17, crest 56 mm., flanks 33 mm.
Bharnabari, February 22, crest 62 mm., flanks 37 mm.

The first example from Hasimara, October 22, an adult ♂, has the coat still short, about the same as in the July Sikhim skin. The general tint is grey, with scarcely a trace of tawny wash, except low down on the flanks; the pattern is distinct as far forwards as the shoulders and consists of black spots forming transverse lines, blotches and loops, showing a buffish speckling on the hind quarters. The second is tawnier, especially on the thighs, and has the pattern, as in the rest with the full coat, much less distinct. They are greyish or tawny or a mixture of the two tints. The coat in the Bharnabari skin, February 22, is very nearly the same length as in the skin from Narbong, Darjiling, March 9. Despite the difference of altitude, I am unable to distinguish these skins from Bhutan Duars from those collected in Sikhim.

Northern Bengal. Two examples, ♂, ♀, collected on March 22 and 24 by C. Crump at Sivok, 500 ft., S. of Darjiling, are of exceptional interest as being the only representatives of the race obtained in Bengal whence the type of *V. zibetha* was recorded. They are indistinguishable from the Bhutan Duars series. The male has a shabby coat, suggesting the start of the moult; the general colour is greyer than in the Bhutan Duars skins collected in February and the pattern is indistinct. The female is as tawny as in the Bhutan Duars skins and the pattern is altogether obscure; the crest-hairs are 62 mm., the flank-hairs 32 mm., very nearly the same as in the Gopaldara Darjiling specimen, April 4.

S. Kamrup. Two examples collected at Rajapara by H. W. Wells seem to extend the range of this race into Upper Assam. A young male, November 27, is almost identical in coat, colour and pattern with the example collected at Hasimara, Bhutan Duars on November 11. A female, November 11, is of interest on account of the dark tawny hue of the pelage, darker than any of the specimens recorded above and the pattern is browner and less distinct, blending with the hue of the interspaces.

THE LARGE CIVET CAT FROM UPPER BURMA AND ASSAM.

Viverra zibetha picta, Wrought.

Viverra zibetha picta, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiv, No. 1, p. 64, 1915; *id. op. cit.*, xxvi, p. 46, 1918.

Locality of type: Hkamti, 500 ft., on the Upper Chindwin River, Upper Burma.

Distribution: Upper Burma and Assam, east and south of the Brahmaputra.

Note on the name: When Wroughton described this race on the evidence of a skin with a short coat and very conspicuous pattern, he must have compared it solely with long coated, obscurely patterned winter skins of typical *zibetha* and overlooked the typical example of *civettoides*, in the British Museum, which it very closely resembles. At all events three years later on the evidence of additional specimens of the species obtained by the Survey, he came to the conclusion that the character had no systematic value and withdrew the name. When, however, I laid out a number of winter skins collected in Assam, I perceived that, on the average, the pattern is a little more distinct, especially on the shoulders, than in winter skins from Bengal, Bhutan Duars and Sikhim assigned to typical *zibetha*. And since the type locality of *picta* is only a short way to the east of Assam, I adopt that name for the Civet Cats from the latter country.

Description: A race of doubtful status resembling typical *zibetha* in the marked difference in luxuriance of coat and distinctness of pattern between summer and winter skins but with the pattern a little less obliterated in the winter, showing, except in one skin, more distinct brindling or spotting on the blackish grey hue of the shoulders and fore quarters. In this particular, as in its geographical distribution, *V. z. picta*, as here defined, serves in a measure to link *V. z. zibetha* with *V. z. pruinosa* described below. No doubt it completely intergrades with both.

The following particulars attest the seasonal variation in the coat and the distinctness of the pattern and the individual variation in tint exhibited by *V. z. zibetha*:—

Coat: Variation in the coat is shown in the following table:—

Skin from Golaghat, 300-400 ft., January 5, crest-hairs 60 mm., flank-hairs 32 mm.

Skin from Golaghat, 300-400 ft., January 12, crest-hairs 61 mm., flank-hairs 39 mm.

Skin from Tura, Garo Hills, 4,000 ft., February 29, crest-hairs 69 mm., flank-hairs 42 mm.

Skin from Duragiri, Garo Hills, 3,000 ft., March 22, crest-hairs 62 mm., flank-hairs 34 mm.

Skin from Jainta Hills, 4,000 ft., July 10, crest-hairs 36 mm., flank-hairs 20 mm.

Type from Hkamti, 500 ft., July 31, crest-hairs 33 mm., flank-hairs 20 mm.

Colour and pattern: The type, an adult ♂, from Hkamti (*J. P. Mills*) is tawny, without any grey, and the pattern is bold and brownish in hue. It closely resembles the type of *civettoides* from Nepal and the example from Pashok, Darjiling, collected on July 19. Of three skins from the Jaintia Hills (*H. W. Wells*), a ♀ obtained at Shangpong, 4,000 ft., July 10, exhibits a pale tawny wash and a very distinct pattern of lines, blotches and loops; a ♂ from Khonshang, 3,000 ft., July 21, has about the same coat and colour, but the pattern is a little fainter; a ♀ from the same spot, July 20, has the pattern less defined, its browner hue blending with the tawnier interspaces.

These examples in the thin, short, summer coat, are not distinguishable from Sikhim examples killed at the same time of the year.

Of the two winter coated examples, entered in the table, from the Garo Hills (*H. W. Wells*), the one from Tura, a ♂, February 29, is greyish with hardly a trace of tawny wash; the other, from Duragiri, a ♀, March 22, differs in exhibiting a distinct tawny wash.

A series of five skins from Golaghat (*J. P. Mills*), collected between January 5 and 22, is very uniform in colour, the pelage being tawny-washed in all; and, as in the examples from the Garo Hills, the pattern is traceable forwards on to the shoulders and is on the average more distinct than in winter coated examples from Sivok, Bhutan Duars, Sikhim and Nepal.

Three skins from the Naga Hills (*J. P. Mills*) must also be referred to. They appear, however, to have been procured from natives. Hence their dates are not absolutely trustworthy, and I have not entered them in the table. A ♂, from Mokokchung, 4,500 ft., dated January 9, closely matches the skins from Golaghat described above. A second from the same locality, 3,500 ft., dated April, has the coat short and thin, the crest-hairs being 35 mm. and the flank-hairs 31 mm.; the general colour is clear grey, without tawny wash even on the belly, and the black pattern stands out in bold relief as far forwards as the shoulders. The third from Okotso, 3,500 ft., dated October 25, is exceptional for this race in exhibiting no pattern on the shoulders, that on the flanks being obscure greyish brown and the ground colour tawny. This specimen is sharply contrasted with the grey tinted, black-patterned example from Mokokchung.

THE LARGE CIVET CAT OF INDO-CHINA.

Viverra zibetha surdaster, Thos.

Viverra zibetha surdaster, Thomas, *Proc. Zool. Soc.* 1927, pt. 1, p. 46; *id. op. cit.* 1928, p. 145.

Locality of type: Xien Khouang, Laos.
Distribution: Laos and Annam.

Provisionally only do I admit this race, the available material being inadequate. It was distinguished by Thomas from the typical and other races of *V. zibetha* by the small size of the auditory bullæ, a point discussed below; but in external characters it seems to differ from *V. z. ashtoni* by its shorter winter coat; from *V. z. picta* by the obscurity of the pattern of the winter coat, and from *V. z. pruinosa* by the greater length of the winter coat and the indistinctness of its pattern.

Three specimens only are available for examination in the British Museum, all collected by A. Delacour and W. Lowe, Xien Khouang in Laos. The type, a subadult ♂. January 3rd. General colour rather pale silvery grey, with no tawny tint on the interspaces; but the pattern obscurely indicated on the hinder part of the body by pale tawny mottling. Hairs of crest 72 mm., of flanks 38 mm.

Kountoum in Annam. A young ♀. March 10. Almost exactly like the type, but not so grey, a tawny wash over the hinder part of the body. Hairs of crest 70 mm., of flanks 34 mm.

Thuy Ba Quangtso, Annam. A half grown ♂. November 1st. Coat short, greyish in colour and showing a very definite pattern of blackish brown transverse stripes like the Nepalese specimen named *undulata* by Gray.

Several specimens in the British Museum from areas to the south of Annam and Laos, mostly from various places in Siam, I have left provisionally unidentified. Two, however, are of some interest, namely, a couple of adult males collected at Pyaunggaung in the North Shan States by G. C. Shortridge. One, May 13, shows the moult in full force, a large number of the grey-banded hairs of the winter coat being shed, displaying the greyish brown under fur and giving a shabby appearance to the pelage; the old hairs of the crest are 75 mm., of the flanks 37 mm. In the other specimen, with the same date, the moult is more advanced. The long hairs of the winter coat are dropped, some of the new ones are just erupting, others are fully up. The crest-hairs are 54 mm.; the flank-hairs, all grey banded, 25 mm. Wroughton assigned these specimens to the following race on account of their grey hue; but the winter coat is much too long for *pruinosa*, being as long as in *surdaster*, to which race they probably belong.

THE LARGE CIVET CAT OF TENASSERIM AND THE MALAY PENINSULA.

Viverra zibetha pruinosa, Wrought.

? *Viverra malaccensis*, Gmelin, Syst. Nat., i, p. 92, 1788.[1]

Viverra zibetha pruinosa, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiv, No. 1, p. 64, 1915; Kloss, *Journ. Nat. Hist. Soc., Siam*, ii, p. 292, 1917.

Viverra zibetha sigillata, Robinson and Kloss, *Rec. Ind. Mus.*, 19, pt. iv, p. 176, 1920.

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[1] The possibility that the name *malaccensis* was given to this Large Malayan Civet and certainly not to the Little Civet (*Viverricula*) of that country is discussed under the latter genus.

Locality of type of *pruinosa*: Thaget on the Little Tenasserim River.

Locality of type of *sigillata*: Bang Nara, Patani, Peninsular Siam.

Distribution: Tenasserim, Southern Siam, Malay Peninsula.

This race was described by Wroughton as differing from *V. z. zibetha* and *V. z. picta* by the greyness of its pelage, without tawny wash. He assigned to it specimens ranging from the Shan States to the Malay Peninsula, the type being from Tenasserim. The colour-character he relied on has not the value attached to it; and his Shan State specimens represent a different race as recorded above. He quite correctly described the Tenasserim specimens as 'grey'. Robinson and Kloss, nevertheless, when discussing *pruinosa*, declared that he must have made a mistake, because specimens from that district are tawny. This statement was based apparently upon an examination of what they called 'paratypes', as well as other specimens presumably from Tenasserim. They thereupon described as representing a new race, named *sigillata*, an example from Patani in Peninsular Siam, which, with some others from the Malay Peninsula, differed, they alleged, from typical *zibetha* and *pruinosa* in their more distinct pattern. I have examined the type of *sigillata*[1] and some other specimens these authors assigned to that race without finding any difference between them and Wroughton's Tenasserim examples of *pruinosa*, except that the latter, being winter skins, have the pattern a trifle less distinct and the coat slightly longer. The truth is that these authors had not, at that time, seen a sufficient number of skins of this Civet to ascertain that distinctness of pattern is a seasonal character and that specimens from the same locality may be tawny, or grey. In their analytical key to the three races discussed they followed the mistaken view of Wroughton that tawny and grey and distinctness of pattern are racial and not individual and seasonal features.

I distinguish this race from the more northern races by the shortness of the coat and the distinctness of the pattern in the winter months, the seasonal variation in these respects being comparatively slight.

This conclusion is borne out by the examples examined from the following localities:—

Bankachon in Tenasserim. December 24. Adult ♂ collected by G. C. Shortridge. Coat quite short, as short as in July skins of typical *zibetha* and *picta*, hairs of crest 54 mm., of flanks 25 mm. General colour decidedly grey, without tawny wash. Pattern distinct but not very strong, consisting mostly of wavy, transverse, joining or separated lines set off by grey interspaces. Another younger example from the same locality, December 6, is generally like the last but is a little tawnier on the thighs.

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[1] This specimen was described as a ♂; but the skin and skull, at present in the British Museum, are marked ♀.

Thaget, Little Tenasserim River. March 28. The type of the race. Very like the examples from Bankachon but not quite so grey, the pattern more blotchy, less lineate and without tawny hue. Hairs on crest 51 mm., on flanks 26 mm. in the winter coat.

Lamra Y'rang, Northern Malay Peninsula. January 8. Hardly distinguishable by colour or pattern from the type. Hairs on crest 43 mm., on flanks 22 mm. This specimen is an almost exact match of the male *sigillata* from Kuala Lumpur.

Mai, S.-W. Siam, 13°50' U., 99°15' E., 650'. March (*K. G. Gairdner* coll.). Pattern quite distinct consisting of brown blotches and bands with pale tawny centres; the interspaces mostly grey, faintly tawny on the hind quarters and still tawnier on the belly. This specimen is very like the Bankachon examples but is more tawny.

Of examples assigned to *sigillata* by Robinson and Kloss I have seen the following. All have the coat short and sleek.

Kuala Lumpur. ♂ ad. September 10. Coat short and sleek, hairs on crest 43 mm., on flanks 20. Colour grey, without tawny wash; pattern distinct, consisting of wavy black lines and blotches.

Pelarit. ♀ young. Differs from the last in having a pale tawny wash on the flanks and abdomen and the pattern less distinct, brindled, more confluent.

Patani. ♀ ad. (type). July 16. Colour a little tawnier than in the Pelarit specimen; the pattern more like that of the male from Kuala Lumpur. Hairs on crest 38 mm., on flanks 20 mm.

Perak, Temengoli. ♂ July. Differs from the others in having a rich tawny wash all over the body. Hairs on crest 34 mm., on flanks 20 mm.

These skins, collected in the summer, have the coat slightly shorter and the pattern a little clearer than the winter skins of *pruinosa* from Tenasserim.

The following table gives the dimensions in English inches in the flesh, with a few weights, of some adult examples of the four races of this Civet recorded from British India. None of the Chinese skins in the British Museum has measurements attached.

Locality and Sex	Head and Body	Tail	Weight
zibetha.			
Sivok, Bengal ♀	32	...	...
,, ,, ♀	30⅖	16½	...
Rajapara, S. Kamrup ♂	32⅘	16⅘	...
,, ,, ♀	31⅗	16⅘	...
Hasimara, Bhutan Duars ♀	30⅘	17⅗	..
Pashok, Darjiling ♂	30⅘	15⅕	...
Rongli, Sikhim ♀	29⅘	16½	20 lbs.
Banso Bahari, Nepal ♂	22⅘	18⅘	21 lbs.
Gorkha, Nepal ♂	30½	18⅖	...
,, ,, ♀	32⅖	14⅘	20 lbs.
,, ,, ♀	30⅖	16⅘	...
Bankulwa Morang, Nepal ♀	31⅕	17⅘	...

Locality and Sex	Head and Body	Tail	Weight.
picta.			
Upper Chindwin (type) ♂	32	17	17½ lbs.
[1]Golaghat, Assam ♂	36⅘	20⅖	...
Sadiya, Assam ♂	34	17⅗	...
Tura in the Garo Hills ♂	28⅕	16⅘	...
Duragiri, Garo Hills ♀	29⅕	14⅘	18½ lbs.
Jaintia Hills ♀	32⅘	16⅕	16 lbs.
(?) *surdaster.*			
Pyaunggaung, N. Shan States ♂	33⅗	18⅗	20 lbs.
Pyaunggaung, N. Shan States ♂	32	17⅘	19½ lbs.
pruinosa.			
Bankachon, Tenasserim ♂	31⅖	17	21 lbs.
Thaget, Tenasserim (type) ♀	30⅖	17⅕	19 lbs.
Patani (type of *sigillata*) ♀	32⅘	17⅖	...
Kuala Lumpur ♂	32⅖	19⅘	...

These measurements show that there is no appreciable difference in size between the sexes of this Civet nor between the four races tabulated. The dimensions of the type of *surdaster* are omitted, because it is immature, like all the examples assigned by Thomas to that race.

The following are some skull measurements of different races. The cranial dimensions are given in English inches; the bulla and the upper carnassial tooth in millimetres. Unless otherwise stated the skulls are adult. The dimensions show no racial differences and at most only slight inferiority in ♀ skulls.

Locality and Sex	In English inches				In mm.	
	Total length.	Zygom. width.	Waist width.	width. Max.	Bulla.	Upper Carn.
ashtoni.						
Chin Kiang ? ♂	5·8	2·6	·8	·9½	19	15×8
Chin Kiang ♀	5·6	2·6–	·8	·8	19	14×8
zibetha.						
Bankulwa Morang, Nepal ♂	5·9	2·8½	·8	1·0	20	14×8
Gorkha, Nepal ♂	5·6	2·6	·6–	1·0	15	15×9
Pashok, Darjiling (old) ♂	5·6	3–	·8	1·1	17	14×8
Rongli, Sikhim ♀	5·4½	2·7	·8	·9	19	14×8
Duars ♂	5·6	2·7	·8	·9	20–	15×8
Sivok, Bengal (old) ♀	5·6½	2·8	·7	1·0	20	...
Sivok, Bengal (old) ♀	5·5	2·6	·7½	·9	20	...

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[1] I have entered the dimensions of this seemingly unusually large specimen as written on the label. I suspect, however, that the collector added 100 mm. both for the head and body and the tail.

Locality and Sex	In English inches				In mm.	
	Total length.	Zygom. width.	Waist width.	width. Max.	Bulla.	Upper Carn.
picta.						
Upper Chindwin (type) ♂	5·4	2·7	·8	·9+	17½	14×7
Garo Hills, Assam ♂	5·4	2·5½	·7	·9	20	14×7
Garo Hills, Assam ♀	5·4	2·8	·8	·9−	18	...
Golaghat, Assam ♂	5·6	2·7½	·7	1·0	...	...
Jaintia Hills, Assam ♀	5·5	2·6	·8−	·9	19	14×8
surdaster.						
Laos (type) (young) ♂	5·2	2·4	·7½	·9	15	15×8
Backan, Tonkin ♂	5·8	2·6	·8½	1·0	17	15×8
Phurieng, Cochin China ♀	5·3	2·6	·8−	·9	18	13×8
N. Shan States ♂	5·7	2·8	·8	1−	20	13×8
N. Shan States ♂	5·6	2·7	·8½	·9	17	15×8
pruinosa.						
Tenasserim, Thaget (type) ♀	5·5	2·8	·8−	·9½	21	15×8
Tenasserim, Bankachon ♂	5·3	2·8	·7	·9	17	15×8
Kuala Lumpur (young ad.) ♂	5·9	2·7	1·0	1·0	21	14×9
Patani, Siam ♂	5·7	2·7	·7	1·0	20	14×8
(type of *sigillata*) ♀	5·5	2·6	·7½	·9	19	14×8

The chief point of interest connected with these skulls is the variation in the length of the bulla upon which *surdaster* was based. It may be seen, however, that of the two examples of typical *zibetha* from Nepal, one from Gorkha has the bulla much shorter than the other, as short as in the type of *surdaster*, although a much older and larger skull. Similar individual variation of the bulla is attested in other races, notably by the two skulls of *pruinosa* from Tenasserim. Here and elsewhere in this paper it is the inflated posterior part of the bulla including the paroccipital bone behind it that is measured, not the anterior part, or tympanic bone, encircling the auditory orifice.

THE TANGALUNG CIVET.

Viverra tangalunga, Gray.

Viverra zibetha, Raffles, *Jr. Linn. Soc.*, xiii, p. 231 (not of Linn.).

Viverra tangalunga, Gray, *Proc. Zool. Soc.*, 1832, p. 63; *id. Cat. Carn. British Mus.*, p. 47, 1869, and of subsequent authors including Lindsay, *Journ. Bomb. Nat. Hist. Soc.*, xxxiii, p. 146, pls. 1 and 2, 1928.

Viverra tangalunga lankavensis, Robinson and Kloss, *Rec. Ind. Mus.*, xix, p. 177, 1920.

Locality of type of tangalunga: Sumatra.

Locality of type of lankavensis: Langkawi Isl., Straits of Malacca.

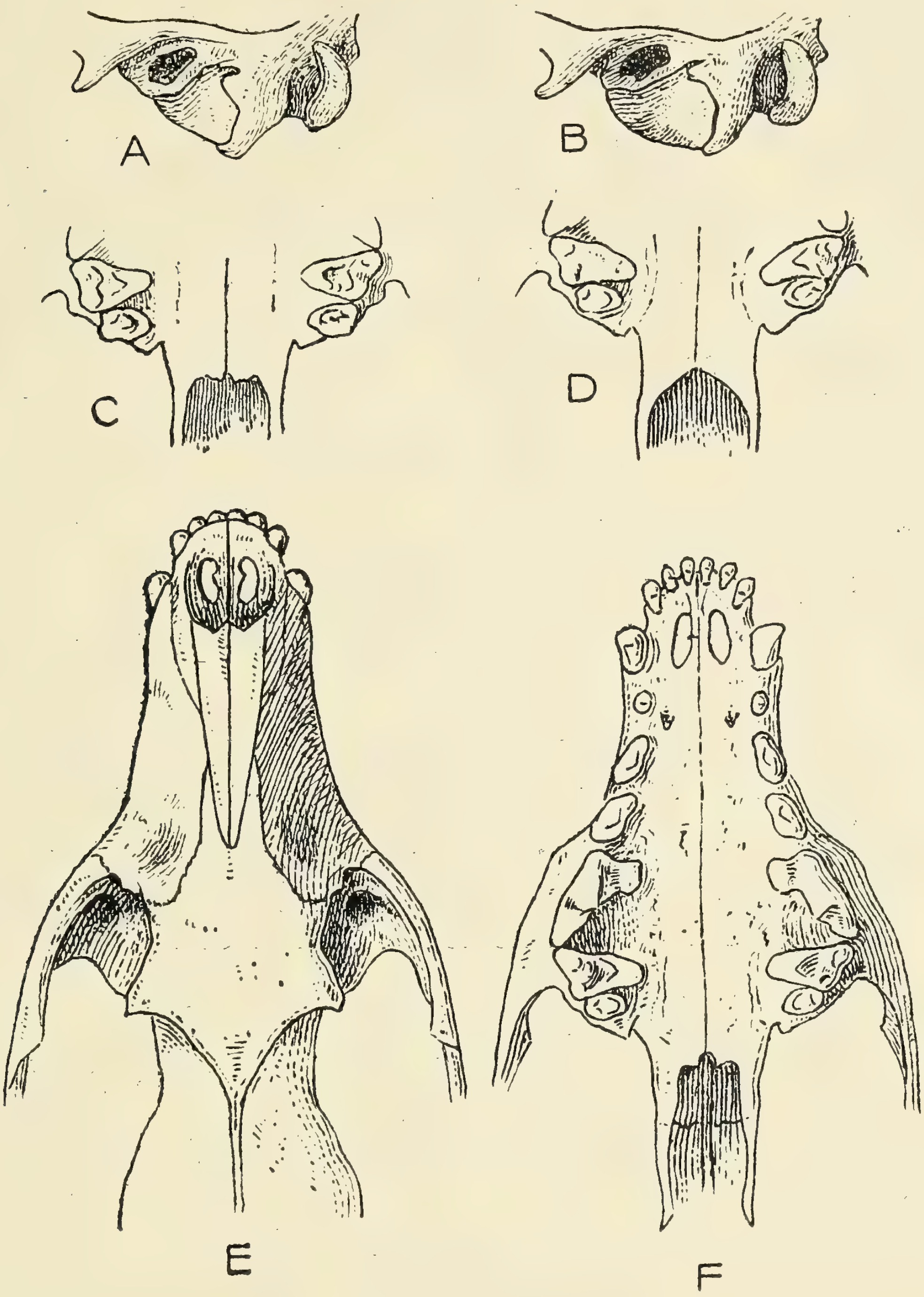

Fig. 2.—A & B. Outer view of the left auditory region of two skulls of *Viverra zibetha* from Gorkha, Nepal, to show individual variation in the size and shape of the bulla. C & D. Hinder end of the palate of the skull of *V. zibetha* from Kuala Lumpur and Chin Kiang, the difference being of no systematic importance. E. Fore part of the skull of *V. zibetha* from North Shan States for comparison with those of *Moschothera* (Fig. 4, B & C). F. Palate of skull of *V. zibetha* from Bhutan Duars for comparison with that of *Moschothera* (Fig. 4, A). (All figs. two-thirds natural size).

Distribution: Malay Peninsula; Sumatra; Borneo; Philippine Islands and Moluccas.

Notes on the synonymy: Raffles, who was acquainted with this Civet Cat in Sumatra, where it is known as the Tangalung, erroneously identified it as *Viverra zibetha*. Gray, perceiving the error, described it as *Viverra tangalunga*. Comparatively recently Robinson and Kloss gave the subspecific name *lankavensis* to a single example collected on Langkawi Island. For reasons given below I am unable to agree with their view.

Description: Distinguishable from *V. zibetha* by its smaller size and difference of pattern, especially on the tail. The black dorsal stripe is continued along the upper side of the tail to its apex; on the sides of the tail there are some fifteen black stripes passing downwards from the median band but encircling the tail below only at its distal end. On the flanks the pattern consists of more definite spots, generally numerous and small and not exhibiting the tendency to run into vertical bands producing the brindled or 'mackerel' pattern of *V. zibetha*. The size is about one-fourth smaller than that of *V. zibetha*, the head and body measuring about two feet and the tail a little over one foot (see below p. 441).

Mrs. Lindsay recently discussed the cranial characters of *V. tangalunga* with those of *V. zibetha;* but, apart from size, there seem to be no differences of moment between the skulls and teeth of the two species. The skull of the topotype from Sumatra referred to below has a total length of 4.6 in. and a zygomatic width of 2.4 in.

The British Museum has only about a dozen skins of this species, most of them being from scattered localities, unmeasured and undated. They do not, in my opinion, supply any evidence justifying the division of the species into local races; but they show variation in the tint of the ground-colour and in the distinctness of the pattern comparable to that which obtains in *pruinosa*, the southern race of *V. zibetha*.

Sumatra. A single adult example, a topotype of the species, received from the East India Company. The ground colour is darkish grey, with some ochreous buff speckling in the hairs of the dorsal area and adjoining the spots which are numerous, irregular in shape and blackish in tint; the tail has about 15 dark lateral bands.

Malacca. (Argent Coll.). A young example with the ground colour much darker, greyish brown, the pelage being much more profusely speckled with ochreous buff and the pattern on the back and flanks much less distinct than in the Sumatran specimen.

Borneo. Two examples collected in November and December by C. Hose on Mount Dulit, 1,000 ft., in Baram. One is greyish brown like the Malaccan specimen but has the pattern better defined. The other is decidedly paler and greyer. One ticketed Borneo (*J. Brookes*) and one from the mainland opposite Labuan (Low) resemble the first described example from Mount Dulit, but one from Mount Kalulong (*C. Hose*), collected in February, is noticeably greyer, a little paler than the topotype from Sumatra.

Philippine Islands. Three specimens. One from Panay has a good deal of silvery grey speckling in the interspaces and resembles the Mount Kalulong example. A second ticketed merely Philippines has similarly greyish speckling but the pattern instead of being emphatic and blackish is quite obscure and brownish. A third from Negros (*Cuming*) is not so grey, resembling the browner Borneo specimens.

Moluccas. An example from Buru Island comes nearest to the specimen from Mount Kalulong, the interspaces on the hind quarters being quite grey.

The type of *lankavensis*, an adult ♀, from Langkawi Island in the Straits of Malacca, is at present deposited in the British Museum. It was described as differing from Peninsular Malayan and Bornean specimens, regarded by the authors as typical *tangalunga*, in its paler, less buffy ground colour, with the spots on the body and the rings on the tail smaller and less conspicuous. The pattern, however, is much more distinct than in the example from Malacca described above. The ground colour, it is true, is decidedly paler than in that specimen and the browner Bornean and Philippine specimens; but it differs much less markedly in that respect from the Sumatran specimen and still less from the example from Mount Kalulong in Borneo. It is, moreover, in bad coat, most of the long hairs on the flanks and the sides of the thighs and shoulders being moulted and the pattern on the exposed underwool is naturally less conspicuous, being greyish black. The specimen is admittedly a whiter grey, especially on the head, than the greyest of the others; but the colour-variation of the others is too great to admit the systematic importance that has been attached to the deviation.

The following are the dimensions in the flesh given by Kloss of two examples in the British Museum:—

Locality and Sex	Head and Body	Tail
Langkawi Island ♀	26″	13 3/5″
Saribas, Sarawak ♀	23″	12 2/5″

Genus: MOSCHOTHERA, nov.

Type of genus: *Viverra civettina*, Blyth.

Distinguished from *Viverra* by the complete absence of skin-lobes forming claw-sheaths on the 3rd. and 4th. digits of the fore paws and by the scanty hair-growth on the area of the paws between the planter and digital pads (Text-Fig. 3, p. 442). The skull differs from that of *Viverra*, as Mrs. Lindsay pointed out, in the suppression of definite postorbital processes on the frontal bones, these processes being represented merely by ridges marking the anterior insertion of the temporal muscles; the sagittal crest is a low ridge. Also the nasals and the whole facial portion of the skull are longer, the site of the postorbital process being set farther back nearly vertically above the corresponding small process on the malar, so that the distance from the anterior edge of the premaxilla to that spot on the frontal noticeably exceeds the distance from that spot to the occipital crest. In *V. zibetha* the postorbital frontal processes are set in advance of the malar processes and are almost exactly in the middle of the skull. The nasals too are shorter in the latter species (Text-Fig. 4, B, C, p. 447).

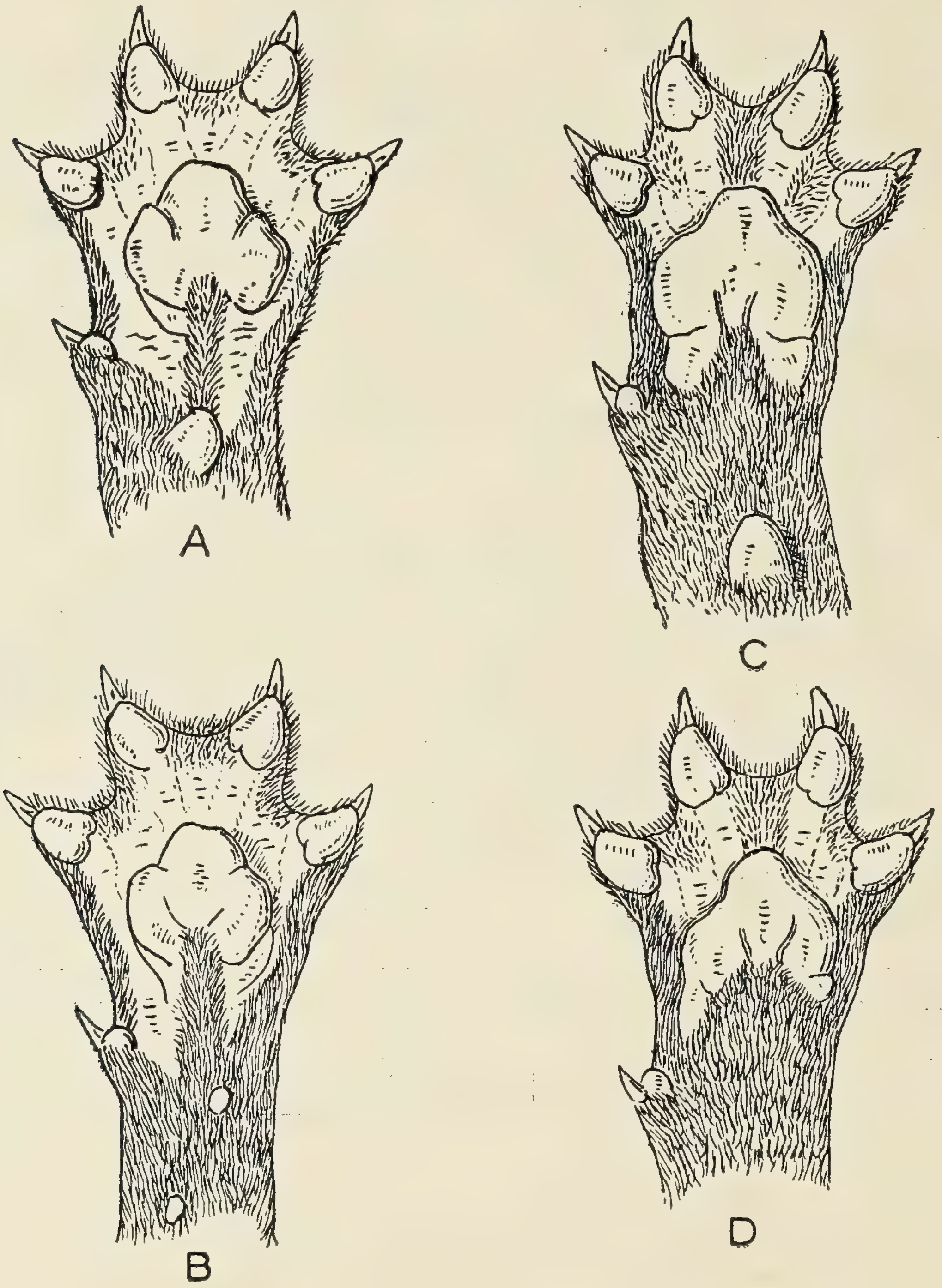

Fig. 3.—A. Lower side of the left fore paw of *Moschothera civettina*. B. The same of left hind paw. C. The same of left fore paw of *M. megaspila*. D. The same of left hind paw.

To this genus I assign the two species hitherto cited as *Viverra civettina* and *V. megaspila,* which are not well known. Blyth, Blanford and others considered them to be distinct; but Robinson and Kloss, who saw Blyth's specimens in the Calcutta Museum, at once detected their kinship and regarded them as representing mere local races of a single species, *V. megaspila,* equivalent to *V. zibetha* or *V. tangulunga.* Mrs. Lindsay, however, who examined the same specimens and several others of all the species assigned to *Viverra,* reverted to the old view of the specific value of the differences between *megaspila* and *civettina.* I agree with her on that point; but with Robinson and Kloss in thinking that these two species are much more nearly akin to one another than either is to *Viverra zibetha* or *V. tangalunga.*

It is to be regretted that no examination has been made on fresh specimens of *M. civettina* and *megaspila* of the feet and scent-pouch, which are well-known in *Viverra zibetha* and *Viverricula indica.* But the structure of the feet on the skins of *M. civettina* from Trivandrum, described below, completely bears out Mrs. Lindsay's contention that this species is a more primitive type than *V. zibetha.*

At present there is not a sufficient number of skins to establish differences, if any, in colour and pattern between these two species. They may be distinguished, however, as follows:—

a. Area round the plantar pads comparatively well clothed with hair; no trace of metatarsal pads above the plantar pad on the hind foot. Skull with very weak divergent crests on the frontal bone and lower edge of mandible less emarginate behind; teeth smaller ... ... *megaspila.*

a^1. Area round the plantar pads comparatively naked; remnants of the metatarsal pads persistent. Skull with stronger divergent crests on the frontal bone and lower edge of mandible noticeably emarginate behind; teeth larger ... ... *civettina.*

Moschothera megaspila, Blyth.

Viverra megaspila, Blyth, *Journ. As. Soc. Bengal,* 31, p. 331, 1862; *id. Proc. Zool. Soc.,* 1864, p. 484; Gunther, *Proc. Zool. Soc.,* 1876, p. 428, pl. 37; Blanford, *Mamm. Brit. India,* p. 99, 1888; Sclater, *Cat. Mamm. Ind. Mus.,* pt. 2, p. 227, 1891; Robinson and Kloss, *Rec. Ind. Mus.,* 19, pt. 4, p. 175, 1920; Lindsay, *Journ. Bomb. Nat. Hist. Soc.,* xxxiii, p. 146, pls. 1 and 2, 1928.

Locality of type: Prome in Lower Burma. (A native skin.)

Distribution: From Southern Burma, Siam, Annam and Cochin China to the Malay Peninsula.

The British Museum has only 11 skins and 3 skulls of this species. The skins are mostly odd specimens from widely separated localities, without dates or measurements, and were apparently procured by their donors from natives. No data justifying the division of the species into local races are available.

The only specimens with full particulars are two females collected for the 'Survey' by G. C. Shortridge. It will be convenient to consider these first.

Victoria Point, Tenasserim, Nov. 27. General colour grey with a decided ochreous tawny wash on the shoulders and a very faint tawny wash on the interspaces behind. Pattern composed of small, scattered indistinct spots on the shoulders, of large, black, well separated spots on the flanks, the uppermost arranged in a longitudinal line on each side of the dorsal crest on the loins. The tail has 7 white stripes below, the first three extending some distance dorsally, the next three restricted to the ventral surface, and the last, the thinnest of all, completely encircling the tail near its apex. The coat is rather harsh, not thick and woolly, the crest-hairs measuring 48 mm. and the flank-hairs 30 mm. The flesh-measurements are: head and body 30 in., tail 14¾ in.

Tenasserim Town, March 9, differs from the last in being slightly tawnier in hue and decidedly harsher in the coat, with the crest-hairs 67 mm. Also the tail has only 5 dorsally incomplete rings in its proximal portion, the distal portion being entirely black. Flesh-measurements: head and body 31¾ in., tail 15¼ in.

These two specimens resemble *Viverra zibetha pruinosa* from Tenasserim and elsewhere in having the coat short and the pattern distinct in the winter months, the crest-hairs longer in March than November and the coat beginning to deteriorate in the former month. The size is very much the same as in *pruinosa;* but the tail is relatively shorter, being only about half the length of the head and body.

Some interesting variations in colour and pattern are shown by other specimens.

A skin from Allagappa village, 30 miles west of Sagaing, Burma, given to Shortridge by Major Owens, shows the moult just beginning, the black hairs on many of the spots being already shed and revealing the grey underfur. For the rest the pattern is black and stands out boldly against the clear, silvery grey interspaces, there being no approach to the tawny hue of the Tenasserim specimens apart from a faint buff wash on the fore quarters. The hairs of the crest are up to 70 mm. in length, the flank-hairs 25 mm. Allagappa seems to be the most northern point in Burma whence the species has been produduced.

A flat, native skin from Nan in Siam (*T. H. Lyle*) is pale tawny gray with the pattern yellow, golden-brown; the crest-hairs are 48 mm., the flank-hairs 30 mm.

From Nahtrang in Annam, 1,200 ft., Dr. Vassal sent a skin like the one from Tenasserim Town, with the crest-hairs 40 mm., the flank-hairs 27 mm.

Two skins from Saigon in Cochin China (*Pierre*) differ considerably in tint. One is coloured very much as in the Tenasserim skins, but the pattern is not so bold, the spots being smaller, less widely spaced and showing a tendency to fuse into blotches and stripes. The hairs on the crest are extraordinarily long, 100 mm., those on the flanks being 30 mm. The other has a much deeper tawny wash and on the fore part of the flanks the spots run into two vertical stripes. The crest-hairs are 60 mm., the flank-hairs 28 mm.

Another skin from Cochin China, brought by Delacour and Lowe from Tayninh, is very different from the Saigon specimens, the ground colour being golden buff and many of the large, widely spaced spots rusty in hue; on the back the spots adjacent to the crest form a complete longitudinal stripe on each side. The crest-hairs are 58 mm., the flank-hairs 25 mm.

An adult female from Pinang in Malacca (*Dr. Cantor*) resembles the specimen from Victoria Point in boldness of pattern and is altogether very like the skin from Nan in Siam, the ground colour being pale tawny grey and the pattern dark brown. The crest-hairs are 52 mm., the flank-hairs 26 mm. A half-grown specimen from the same locality is greyer and duskier, with the pattern more confluent in lines as in the examples from Saigon, Cochin China.

Like the adult ♀ from Pinang, but not quite so tawny, is a skin ticketed Malacca (*J. C. Marshman*). The crest-hairs are 57 mm., the flank-hairs 29 mm.

The specimens above described show the following points:—

1. The ground colour varies from silvery grey to golden buff and tawny.

2. The pattern varies from black to brown; the spots may be large or comparatively small, separated or sometimes fusing into blotches or into transverse stripes behind the shoulders, or a pair of longitudinal stripes on the back.

3. The crest-hairs vary in length from a little under 50 to 100 mm., the average being about 60 mm.; the flank-hairs vary from 25 to 30 mm. The coat is thus somewhat longer than in *V. z. pruinosa*, but there is no evidence that this means a more elevated habitat.

Moschothera civettina, Blyth.

Viverra civettina, Blyth, *Journ. As. Soc. Bengal*, 31, p. 332, 1862; *id. Proc. Zool. Soc.*, 1864. p. 484; Blanford, *Mamm. Brit. Ind.*, p. 98, 1888; Sclater, *Cat. Mamm. Ind. Mus.*, pt. 2, p. 227, 1891; Robinson and Kloss, *Rec. Ind. Mus.*, 19, pt. 4, p. 175, 1920; Lindsay, *Journ. Bomb. Nat. Hist. Soc.*, 33, p. 146, pls. 1 and 2, 1928.

Locality of type: Travancore.

Distribution: The coastal district and Western Ghats of southern India.

Like its near ally *M. megaspila*, this species is now apparently very rare,[1] although Jerdon said it was 'abundant' in Travancore when he was there. In the British Museum there are only two specimens, as recorded by Mrs. Lindsay.

Travancore. An adult ♂ example secured, with another specimen, from the Trivandrum Zoological Gardens by Mr. W. S. Millard for the Bombay Natural History Society and generously presented to the British Museum. Coat tolerably long and full, with grey underwool; hairs on crest up to 50 mm., on flanks up to 30 mm. Ground colour tolerably clear grey, greyer than in all the examples of *M. megaspila* I have seen except the one from Sagaing in Burma. Pattern black or nearly so, smaller and not so spaced as in most skins of *M. megaspila* but hardly differing from that of the skins from Saigon in Cochin China; more spotted on the shoulders and on the thorax below. Tail[2] with the white rings better developed than in *M. megaspila*, five in number and all of them reaching well up the sides of the tail, the last only about two inches from the tip; in *M. megaspila* the terminal six inches or so of the tail are typically black. Muzzle with more white on the chin and behind the nose above. Bands on the throat in some respects intermediate between those characteristic of *V. zibetha* and *M. megaspila*, consisting of three black stripes passing from the sides of the neck to its lower surface where they become irregularly branched and bent and, meeting in the middle line, border two white areas which are correspondingly irregular. The median black band is not so broad as in *V. zibetha* but broader than in *M. megaspila*, in which the anterior and posterior bands do not, as a rule at all events, pass on to the lower surface of the neck. *Measurements*: head and body 30 in., tail 13 in., practically the same as in the female examples of *megaspila*, but the tail shorter. Weight 14½ lbs.

With only one good skin to judge from, it would be rash to infer that the differences in pattern pointed out above between it and skins of *M. megaspila* are constant. Considering, indeed, the general similarity between the two forms, it is not surprising that Robinson and Kloss regarded *M. civettina* as a subspecies of *megaspila*, despite their wide geographical separation. There are, however, some characters in the feet and skull justifying the specific status of *M. civettina*.

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[1] The late Mr. Harold Ferguson, when he was a member of the Council of the Zoological Society of London, after his retirement from service in Trivandrum, made special efforts, at my request, to secure specimens of this species for Regent's Park. His successor at Trivandrum reported that he had had no difficulty in getting a pair and was sending them with a consignment of other animals from the country. The creatures turned out to be the common little Indian Civet (*Viverricula indica indica*)! Did Jerdon fall into the same error?

[2] Blanford, who had not seen a specimen of this Civet, was mistaken in describing the white bands on the tail as forming complete rings like those of *Viverra zibetha*.

The paws of the Travancore skin differ from those of the specimen of *M. megaspila* from Victoria Point in being less hairy below.

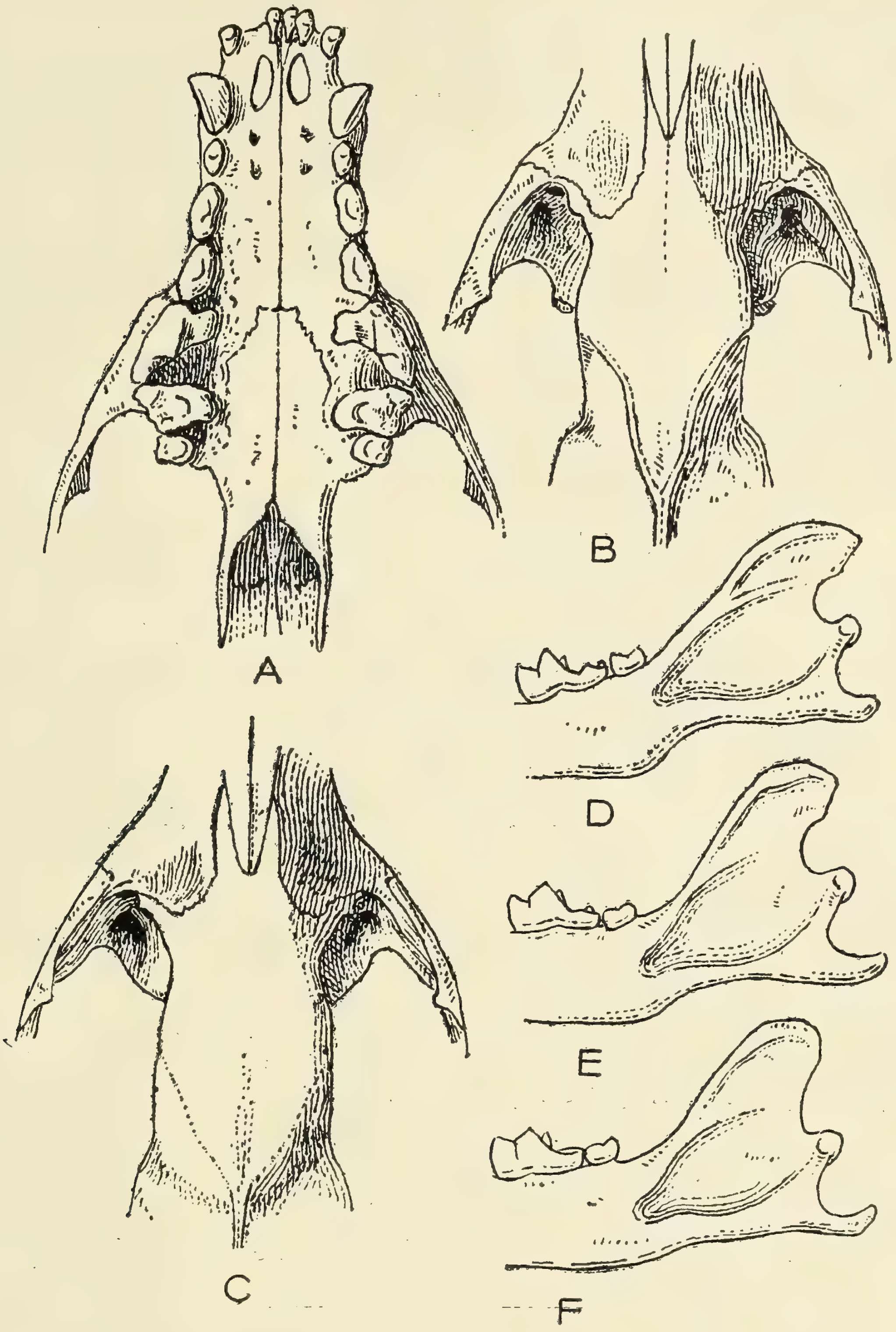

Fig. 4.—A. Palate of skull of *Moschothera civettina* from Trivandrum. B. Forehead of the same specimen. C. The same of the skull of *M. megaspila* from Tenasserim Town. D. Posterior portion of mandible of Raffles' skull of *M. civettina*. E. The same of skull from Trivandrum. F. The same of skull of *M. megaspila* from Tenasserim Town. (All figs. two-thirds natural size).

On the interdigital webs the hairs are close to the margin and remote from the plantar pad. On the fore paw the naked area behind the plantar pad reaches to the carpal pad but is divided by a narrow median band of hair reaching from the carpal pad to the middle of the plantar pad. Similar differences are to be seen on the hind paw; but, in addition, there are two little naked areas, one above the other, between the plantar pad and the hock, representing remnants of the metatarsal pads. No trace of these interesting relics is to be seen in *M. megaspila*, which has the lower side of the feet both behind and in front of the plantar pad altogether less naked as shown in the figure (Text-Fig. 3, C & D, p. 442).

The second specimen in the Museum (No. 84, 6-3-11) is in poor condition; but, so far as can be judged, it resembles the one described, making allowance for soiling of the grey hairs and fading of the pattern to brown from exposure to light as a mounted, exhibited specimen. Its locality is unknown.[1]

The following table shows that the skulls of the adult females of *megaspila* are a little longer than those of the adult male of *civettina* but practically the same width everywhere. The two skulls of *megaspila* from Tenasserim illustrate the effects of wear upon the teeth. In the younger example from Tenasserim Town, the premolars, practically unworn, are almost in contact at the base above and below, and when the jaws are closed those of the mandible fill the spaces between those of the upper jaw and *vice versa*. But in the older example from Victoria Point the worn premolars are very definitely separated so that when the jaws are closed tolerably wide gaps are left between the opposed upper and lower premolars. In the two skulls of *civettina* the gaps in question are filled as in the younger of the two skulls of *megaspila*. Although Mrs. Lindsay said that these skulls 'are identical to the type specimen', this can only be true of the skull from Trivandrum, which certainly appears to be like that of the type, so far as can be judged from Mrs. Lindsay's photographs. But the skull of Raffles's specimen shows some marked differences notably in the post-dental part of the mandible, the anterior edge of the coronoid showing a strong backward slope, so that the posterior apex of this process, the condyle and the tip of the angular process are more nearly in a vertical line. Moreover, the emargination on the lower edge of the mandible is much more pronounced. I attach no importance, however, to these differences, because I feel sure they are due to the Civet having been reared in captivity from cubhood. Perhaps the same explanation applies to the separation on the crown of the two temporal ridges which behind their point of divergence run side by side as a double crest over the parietals[1] (Text-Fig. 4, D, E, F, p. 447).

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[1] This specimen has a curious history. It belonged to Dr. Crisp and was purchased with a number of miscellaneous mammals from Europe, America, India, Sumatra and elsewhere and was entered in the B. M. register as '*Viverra megaspila*, Sumatra, T. S. Raffles'. But it has no original label containing that information. I can only suppose that Thomas identified it as *megaspila*, which was natural enough. But if it belonged to Raffles's collection, it can hardly have come from Sumatra, because as Mrs. Lindsay showed from an examination of the skull, it belongs to the Travancore species, with which Thomas was unable to compare it. There is, moreover, no reason to believe, so far as I am aware, that *megaspila* occurs in Sumatra. In any case, as stated below, the animal had been in captivity for some time and may have been given to Raffles either before or after its death.

	In English inches				In mm.	
Locality and Sex	Total length.	Zygom. width.	Waist width.	Max. width.	Bulla.	Upper Carnal.
civettina.						
Travancore, ad. ♂	5·7	2·9	·9½	1+	18	14×8
(S. India; Raffles) ?♂	...	2·8½	1·0	1·1	...	14×9
megaspila.						
Tenasserim Town, ad. ♀	5·9	2·9	1·1	1½	20	14×8
Victoria Pt, Tenasserim, ad. ♀	6·0	2·8½	1·1	1	18	13×8
Pinang	5·9	2·8	1·0	1·1−	20	14×8

(*To be continued*).

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[1] The photographs of the skull of the type-specimen of *M. civettina*, published by Mrs. Lindsay, are said to be half natural size. The reduction, however, is clearly more than that amount. In her table of measurements, for instance, the zygomatic width is given as 76 mm., which agrees very closely with that of the skull in the British Museum, but the width in the photograph is only 33 mm., which doubled gives 66 mm.

THE BUTTERFLIES OF BANGALORE AND NEIGHBOURHOOD.

BY

J. A. YATES.

This account of the Butterflies of Bangalore and its neighbourhood could not have been attempted, or, if attempted, have been anything like complete, had I not had the privilege of consulting the remarkably detailed note-books and of seeing the collection of Col. H. C. Winckworth, R.A.M.C., who kept records month by month of the flies taken by him in and around Bangalore in the years 1925, 1926 and 1927. I must acknowledge also the very great help given me in this compilation by his brother, Mr. R. Winckworth.

Col. Winckworth not only collected butterflies himself but trained a servant to make daily catches throughout the year at certain spots in Bangalore and the neighbourhood. My own observations began not many months before Col. Winckworth left the place, and I had little to add to what he had observed. I was able however to go further afield and to explore some of the jungles which are scattered about the plateau and so to include a somewhat wider area than he traversed.

I am indebted to Rev. C. N. Marcon, who was at the time on the staff of Bishop Cotton Boys' School, for information on a few points, notably regarding the presence of *Charaxes polyxena imna* in Bangalore. Evans (*Identification of Indian Butterflies*, 1st Edition) specifically mentions Bangalore as a locality for *Apharitis lilacina*, taken by Watson, whose specimen is in the British Museum, and for *Sarangesa sati hopkinsi*, which I took near Oorgaum (Kolar Gold Fields), and Mr. Marcon took on the Mysore Road eight miles out of Bangalore.

Bangalore stands at a corner of a 3,000 ft. plateau. To the north and north-west, to the east and north-east almost to Kolar town, and to the south-east beyond Hosur the level varies little, 100 feet or so above or below, except in the drainage basin of a river such as the Palar, till the Eastern Ghats are reached, when the land falls away rapidly by rough jungly valleys, with rocky hills between them, towards the plains. The Ghats are much nearer in the south-east, and consequently the area of high land is more restricted than to the east, in which direction one goes thirty-five miles or so before a drop occurs. Due north of Bangalore at a distance of thirty-five miles is a big block of wooded hills rising from the plateau, the highest of which is Nandidroog (4,800 feet). Thirty-three miles, E.N.E., a few miles before reaching Kolar town, is a tumble of much-weathered rocky hills with sparse jungle on them. North-east, at about the same distance from Bangalore, there are big hills near Chintamani. The country between Bangalore and all these hills is a rolling plateau, of low ridges, mostly without escarpment, alternating with shallow valleys well provided with irrigation tanks and cultivated land.

Dotted all over this country, mostly on the higher levels, are patches of State forest, of varied shapes and sizes, preserved out of the wide spaces of uncultivated and largely uncultivable scrub jungle, which in ages of occupation has been cut down for firewood by the inhabitants of the numerous hamlets and villages or used by them as grazing ground for flocks of sheep and goats. Many of these reserved forests lie away from the roads, and are mostly too far off to be of use to the entomologist who relies on a car for his exploration. The main object of their reservation is the protection of the parasitic sandal trees, for which he who hunts butterflies is truly grateful, since few trees in the jungle are, when in flower, more attractive to butterflies, especially Lycænids and Hesperids than the sweetly-scented sandal. These blocks of 'forest' for the most part consist of low bushy trees with hard leathery leaves, but there are scattered about in them trees of larger growth, fig, acacia, mango, maddi; much thorny scandent vegetation; and numerous low annual and perennial flowering plants. Though the flower is most abundant when the rains happen, there is throughout the year some tree or plant in flower, and, even when the season appears most unpromising and the ground is hard and parched, there are butterflies in surprising numbers to be had.

In one of these Forests or Plantations, Koramangala R.F., beyond Devanahalli in the direction of Nandidroog, *Zesins chrysomallus* was obtainable throughout the year. Other favourite hunting grounds of mine were Jakkur Plantation, eight miles from Bangalore, near Yellahanka on the Devanahalli Road; Chikkahardi R.F. near Jangamkota on the road from Kolar to Dodballapur; Banerghatta Lac Reserve, thirteen miles to the south of Bangalore; the rough hills about the Arkavati River on the Magadi Road, where a new reservoir for the water-supply of Bangalore is projected.

To the S.W. of Bangalore the land falls rapidly; the country is broken, wilder and more wooded, or at least more jungly and uncultivated than the level area of the 3,000 feet plateau. As soon as one leaves Bangalore by the Mysore Road the change in the appearance of the country begins; cultivation is sparse; the surface becomes broken; there are frequent nullahs or in the rainy months streams, and at twenty miles one begins a steady descent through a belt of rocky, wooded hills, till at Closepet, 30 miles from Bangalore one has dropped nearly 800 feet. So also in another direction; passing behind the Lal Bagh (The Mysore Government Gardens) the road falls continuously through hills and jungle interspersed with cultivated lands to Kankanahalli. The streams all run to the Arkavati, which itself is falling towards the Cauvery basin. A sheet of the one-inch survey map of this locality shows more green, i.e. more wooded hilly country than half a dozen sheets of the plateau east and north-east of Bangalore. This area, if it were not largely ungetatable, should be fruitful ground for the entomologist.

Col. Winckworth took *Horaga onyx* in Bangalore; Mr. Marcon *Charaxes poluxena imna*; and Watson *Apharitis lilacinus*. The first and third of these I saw and took only in the moist evergreen areas; the second, though it occurs in the drier deciduous forest,—only however, so far as my experience goes, near water in the dry season, and away from water in the rains—is relatively rare there. *Aphari-tis lilacinus* has been recorded from Mysore, from which place there are specimens in the British Museum; but there is nothing to show whether they were caught in Mysore itself or in the neighbourhood. I venture to remark in passing that many of the specimens from various collections now brought together in the British Museum, have insufficient data on their attached cards regarding locality. Mysore itself is very different from the surrounding country; it has fine trees, well watered gardens, such as the Palace gardens, and a much more varied vegetation than the immediate rather barren neighbourhood. Mysore area might include irrigated land between it and Seringapatam. So also Bangalore, both Civil and Military station and the City (Mysore State) is, with its numerous gardens private and public, its irrigated lands under vegetable cultivation, and its many fruit orchards, more endowed with large trees and richer in varied vegetation than the country round. But this richer vegetation alone would not, to my mind, suffice to explain the presence of these and possibly other butterflies in Bangalore. I think also one should reject a theory of isolation such as might explain the presence of certain palæarctic butterflies and temperate plants that are found on the higher parts of the Nilgiris and Palnis.

The mention of palæarctic butterflies recalls the fact that in September of 1926, Col. Winckworth took a fresh specimen of *Pieris canidia canis*, Evans in Bangalore. This was a remarkable capture in that this butterfly, a palæarctic, is, so far as S. India goes, generally supposed to be found only in the Nilgiris and Travancore hills. Its presence in Bangalore might be explained by migration; but would a migrant pierid make a solo flight, and, if it did, reach Bangalore, 200 miles from its normal habitat, fresh and undamaged? There is of course the possibility of its having been brought by human agency, as an unnoticed larva or as a pupa in a basket of fruit or vegetables from the upper Nilgiris. *Horaga onyx cingalensis*, *M.* at any rate is too weak an insect to be a migrant. My observation in Coorg was that it is very local in its habits; if found once in an area of about 50 square yards, it will be found there again and not beyond that area. *Charaxes polyxena imna*, But. of which a fresh ♂ was taken in the Lal Bagh in Bangalore in September 1928 is a powerful and swift flier, but for short distances, across a glade or down a stream; I doubt if it is a stayer. *Pareronia ceylanica ceylanica*, *Ed.*, another of Col. Winckworth's recorded Bangalore captures is usually, I think, a dweller in lusher woodland than occurs over the eastern and northern parts of the plateau. I saw no sign of it or of *Pareronia valeria hippia*, *F.* (which also appears to favour damp half-shaded spots, a bosky tank, a well-watered tope, a channelled garden such as that of Tippu's summer palace at Seringapatam) in the dry state Sandal Reservations that I visited. And of the larger Papilionids, *P. polymnestor polymnestor*, *Cr.*, and *P. helenus daksha*, *M.* were taken either in Bangalore, or in broken country to the south-west and west, which is traversed by streams, e.g. near Kengeri on the

Mysore road, or on Nandidroog, which is surrounded and approached by wooded country and, since it catches the rain-bearing winds, is more luxuriantly leafy. I venture to suggest that along the line of the broken wooded country to the south-west into the well-watered and leafy area of Bangalore itself, and along the Arkavati valley towards Nandidroog there is a process of infiltration. This is only a suggestion, but it appears to me to be a more reasonable hypothesis than one of migration or of isolation. It might, though this is doubtful, explain the rare presence of *Pieris canidia canis* in Bangalore; but only careful investigation of the country between Bangalore and the Nilgiris, from the plains to the plateau, along its rivers, its forests and its hills, and the making of a tally of the butterflies to be found there could prove or disprove it.

In the list that follows I have adopted the numbers and nomenclature of Evans' *Identification of Indian Butterflies*, Second edition.

The totals of butterflies so far recorded from Bangalore and neighbourhood are as follows:—

A.	Papilionidae	9
B.	Pieridae	25
C.	Danaidae	6
D.	Satyridae	10
F.	Nymphalidae	20
G.	Erycinidae	1
H.	Lycaenidae	49
I.	Hesperiidae	20
	Total	140

A. PAPILIONIDÆ.

A 2. 9. **Tros hector,** L. Throughout the year.

A 2. 10. **Tros aristolochiæ aristolochiæ,** F. Throughout the year.

A 4. 1 β. **Papilio polymnestor polymnestor,** Cr. Occasional, both in Bangalore and outside. Recorded in February, March, April, August, September and October.

A 4. 13. **Papilio crino,** F. Col. Winckworth records having seen a specimen at Yesvantpur on 8-4-26.

A 4. 19 β. **Papilio helenus daksha,** M. Uncommon in the area. Bangalore and the jungles to the south-west.

A 4. 25 α. **Papilio polytes romulus,** Cr. Throughout the year, everywhere. No record of ♀ *v. cyrus*.

A 4. 27 α. **Papilio demoleus demoleus,** L. Throughout the year, everywhere.

A 5. 4 α. **Pathysa nomius nomius,** Esp. Taken in the months April to August; it is not uncommon in certain areas, e.g., near Yesvantpur, and near the Arkavati River, on the Magadi Road. Like *P. antiphates naira, M.* it comes readily to water.

A 6. 8 α. **Zetides agamemnon menides,** Fruh. Common; recorded from May to January.

B. Pieridæ.

B 1 *a*. **Leptosia nina nina,** F. Recorded throughout the year, in shady places; not very common, the rather thin dry jungles round Bangalore not generally suited to its habits.

B 4. 10 *a*. **Pieris canidia canis,** Evans. Col. Winckworth took one on 10-9-26 in the R.A.M.C. Mess Compound. See remarks in Introduction.

B 6. 3. **Delias eucharis,** Drury. Common throughout the year.

B 8. *β*. **Belenois mesentina mesentina,** Cr. Very common; perhaps the commonest *pierid* in the jungles round Bangalore.

B 9. 2 *a*. **Huphina nerissa evagete,** Cr. Common throughout the year.

B 10. 4 *a*. **Appias libythea libythea,** F. Occasionally taken in the outskirts of Bangalore. Col. Winckworth's records and my own show it as occurring in the following months, January, May, July, August, November, December. It occurs in some, but not all jungles, and, as I noted, keeps rather to certain spots in the jungles. All ♀♀ taken, whether D.S.F. or W.S.F., have reddish abdomens.

B 10. 6 *β*. **Appias albina darada,** Fd. Occurs in most months of the year in and round Bangalore, and is not uncommon. In October 1926, Col. Winckworth records it as 'abundant'. ♀ var. semiflava, though common in Coorg, is rare round Bangalore. Personally, I took only one specimen.

B 11. 1. **Catopsilia crocale,** Cr. }
B 11. 2. **Catopsilia pomona,** Cr. } Both very common and annual.
♀ v. catilla, Cr. }

B 11. 4. **Catopsilia pyranthe minna,** Herbst. } Common, throughout the year.
B 11. 5. **Catopsilia florella gnoma,** F. }

B 15. 1. **Terias libythea, F.** Throughout the year; commoner in the rainy months.

B 15. 2 *a*. **Terias laeta laeta,** Bdv. Common in both D.S.F. and W.S.F. Throughout the year.

B 15. 4 *a*. **Terias blanda silthetana,** Wall. Occasionally plentiful, but not so common generally round Bangalore as the next.

B 15. 5 *a*. **Terias hecabe simulata,** M. Very common, throughout the year.

B 17. 1. **Ixias marianne,** Cr. Common in most months of the year.

B 17. 2 *β*. **Ixias pyrene frequens,** But. Common in most months of the year.

B 18. 1 *a*. **Colotis amata modesta,** But. Throughout the year, where it occurs, but rather local. Not common in the jungles.

B 18. 4 *a*. **Colotis fausta fulvia,** Wall. Almost throughout the year in the jungles in which it occurs; most plentiful from June onwards till January. Local: very occasionally in Bangalore itself.

B 18. 5 *β*. **Colotis etrida etrida,** Bdv. Fairly common through most of the year.

B 18. 6. **Colotis eucharis,** F. As the last.

B 18. 7. **Colotis danæ danæ,** F. Throughout the year. Common.

B 19. *β*. **Hebomoia glaucippe australis,** But. Col. Winckworth records it on four occasions in Bangalore. It is rare here.

B 20. 2 *a*. **Pareronia ceylanica ceylanica,** Fd. Recorded by Col. Winckworth on three occasions. I did not see it: it is rare in Bangalore; more usual in wet areas.

B 20. 3. **Pareronia valeria hippia,** F. Recorded four times by Col. Winckworth. I did not see it in any of the jungles I visited. Perhaps, like the last, attracted to Bangalore iself by the greater variety and size of the trees and the greater frequency of water.

C. DANAIDÆ.

C 2. 9. **Danais limniace mutina,** Fruh.

C 2. 10 β. **Danais melissa dravidarum,** Fruh.

C 2. 12. **Danais plexippus,** L.

C 2. 15. **Danais chrysippus,** L.

All common and sometimes abundant—especially *D. limniace.*

C 3. 7 β. **Euplœa core core,** God. Very common and throughout the year.

C 3. 12 β. **Euplœa coreta coreta,** God. In most months of the year; not as common as the last.

D. SATYRIDÆ.

D 2. 9 a. **Mycalesis perseus typhlus,** Fruh.

D 2. 10 a. **Mycalesis mineus polydecta,** Cr.

These are only occasional in Bangalore. The common *Mycalesis* is

D 2. 14. **Mycalesis subdita,** M.; it occurs throughout the year.

D 3. 21 a. **Lethe europa ragaiva,** Fruh. Uncommon. Taken by Col. Winckworth.

D 3. 22 a. **Lethe rohria nilgiriensis,** Guer. Uncommon. Taken by Col. Winckworth.

D 14. 6. **Ypthima asterope mahratta,** M. The common *Ypthima* round and in Bangalore. Throughout the year.

D 14. 11 β. **Ypthima hubneri hubneri,** Kirby. Only one record by Col. Winckworth.

D 14. 15 a. **Ypthima baldus madrasa,** Evans. I took a specimen in September 1927 in the Banerghatta jungle.

D 16. a. **Orsotriæna medus mandata,** M. Recorded by Col. Winckworth. Rare in this area.

D 22. 1. **Melanitis leda ismene,** Cr. Very common at times; throughout the year.

F. NYMPHALIDÆ.

F 1. 2 β. **Charaxes polyxena imna,** But. Mr. Marcon took a good ♂ in September 1928 in the Lal Bagh.

F 1. 7 β. **Charaxes fabius fabius,** F. Not uncommon. Recorded in February, May, June, August, September. Most plentiful in September.

F2. 2 β. **Eribœa athamas agrarius,** Swin. Never very common as in Coorg, but generally distributed, between June and January.

F 18. 14 β. **Euthalia garuda meridionalis,** Fruh. Throughout the year; sometimes, as in September, abundant, especially in mango topes.

F 18. 28. **Euthalia nais,** Forst. Generally distributed in open spaces in jungles. Common from the beginning of the rains, from May onwards.

F 26. 2 β. **Neptis jumbah jumbah,** M. Occasional, but not common. Recorded in January, May, June, July.

F 26. 6 a. **Neptis hylas varmona,** M. Not common, but more frequent than the last, more or less throughout the year.

F 30. 1. **Hypolimnas misippus,** L. Common throughout the year, everywhere. ♀ *var.* inaria and ♀ *var.* alcippoides both recorded.

F 30. 2. **Hypolimnas bolina,** L. By no means as common as the last; recorded in most months of the year. In largest numbers after the rains break.

F 35. 1 *a.* **Precis hierta hierta,** F.
F 35. 2 *a.* **Precis orithya swinhoei,** But.
F 35. 3 *a.* **Precis lemonias vaisya,** Fruh.
Throughout the year and very common—especially during the rainy months.

F 35. 4 *a.* **Precis almana almana,** L. Common, recorded from March to November.

F 35. 6 *a.* **Precis iphita pluviatalis,** Fruh. Recorded in ten months of the year, but being a shade-loving insect, necessarily less common in the open Bangalore country than the last four.

F 36. 1. **Vanessa cardui,** L. Throughout the year; at times plentiful.

F 42. 1. **Atella phalanta,** Drury. Throughout the year; at times, e.g. after the rains break, abundant.

F 48. **Byblia ilithyia,** Drury. A very local butterfly, but where it occurs fairly plentiful. Not taken in Bangalore. Two good spots were (1) the open country, with clumps of prickly pear and low-growing cassia shrubs, just before reaching Oorgaum (Kolar Gold-Felds); (2) The bank of the bund of a big tank (Badanecheruvu) 30 miles north of Bangalore, where a shrubby cassia was abundant. Seen from July to early January.

F 49. 1 *β.* **Ergolis ariadne indica,** M. Recorded from June to November. Not so common as the next.

F 49. 2 *β.* **Ergolis merione merione,** Cr. Throughout the year; at times, as in September, very common.

F. 52. **Telchinia violæ,** Fab. Throughout the year. General.

G. Erycinidæ.

G 4.5 *a.* **Abisara echerius prunosa,** M. Very local round Bangalore. Seen in numbers only near Banerghatta, under lac-bearing trees, between July and October. Absent in most jungles. Not taken in Bangalore.

H. Lycænidæ.

H 8 *a.* **Spalgis epius epius,** Wd. Throughout the year, and everywhere. At times abundant.

H 10 *a.* **Talicada nyseus nyseus,** Guer. Well distributed; in most months of the year.

H 11. 1*a.* **Castalius rosimon rosimon,** F. The usual *castalius* round Bangalore; throughout the year.

H 11.2 *β* **Castalius caleta decidia,** Hew. Rare. Taken by Col. Winckworth on Nandidroog; also in Banerghatta Jungle.

H 11.3 *a.* **Castalius ethion ethion,** Db. and Hew. Rare. Recorded by Col. Winckworth on Nandidroog.

H 12.9 **Tarucus nara,** Koll. Not common; local. Recorded only in the rainy months, June to August.

H 13. **Syntarucus plinius,** F. Common, and in some months abundant; throughout the year. Especially common in Bangalore itself.

H 14. 1. **Azanus ubaldus,** Cr. Common, and at times, e.g. July and August on acacia flowers, abundant. No record for March and April.

H 14. 2. **Azanus uranus,** But. Both in Col. Winckworth's and in my experience not common. Taken May to July.

H 14. 4. **Azanus jesous gamra,** Led. Not uncommon between April and December in the jungles. Rare in Bangalore itself.

H 18. 5 α. **Everes parrhasius parrhasius** F. A rare fly round Bangalore. Only taken in Banerghatta jungle in September.

H 21. 2 β. **Lycænopsis puspa gisca,** Fruh. Not common near Bangalore. Taken only in Banerghatta jungle in September.

H 23 α. **Chilades laius laius,** G. Throughout the year and common.

H 24. 1 α. **Zizeeria trochilus putli,** Koll. Fairly common throughout the year.

H 24. 3 α. **Zizeeria maha ossa,** Swin. Throughout the year. Common.

H 24. 4. **Zizeeria lysimon,** Hub. Throughout the year. Common.

H 24. 5. **Zizeeria gaika,** Trimen. Throughout the year. Common.

H 24. 6 α. **Zizeeria otis decreta** But. Throughout the year. Common.

H 25. 1. **Euchrysops cnejus,** F. Throughout the year. Common.

H 25. 2 α. **Euchrysops contracta contracta,** But. Not as common as the last. Recorded from May to December.

H 25. 3 β. **Euchrysops pandava pandava,** Hors. Much less common than the last two; more local. Recorded from June to October.

H 26. 2 α. **Lycænesthes lycænina lycænina,** Fd. Throughout the year; common, and at times, especially from June to September, abundant in the jungles.

H 27. 1. **Catachrysops strabo,** F. Throughout the year; common; everywhere.

H 28. **Lampides bœticus,** L. Throughout the year; everywhere; often abundant.

H 29. 1 α. **Jamides bochus bochus,** Cr. Recorded in all months but February and March. Common; abundant in June and July. Flits about bushes and hedges.

H 29. 5 β. **Jamides celeno celeno,** Cr. Universal; throughout the year. Flies low about grass and low growing plants.

H 32. 15 α. **Nacaduba nora nora,** Fd. Throughout the year; common.

H 32. 16 α. **Nacaduba dubiosa indica,** Evans. Less common than the last.

H 32. 19. **Nacaduba dana,** De N. Local, but fairly abundant where it occurs. Taken in July and August, about flowers, e.g. the flowers of *maddhi*.

H 44. 1. **Curetis thetis,** Drury. Common, and obtainable throughout the year, but most abundant from May to September, in mango topes, etc.

H 45. 1 β. **Iraota timoleon arsaces,** Fruh. Not uncommon; taken from July to December; at flowers on bushes near some *ficus*, e.g. Java fig, on which pupæ may be found.

H 49. 39 α. **Amblypodia amantes amantes,** Hew. Taken from April to November. Abundant at times, e.g. in early May, on mango trees or *Eugenia jambolana;* also on other trees and shrubs.

H 56. 3. **Apharitis lilacinus,** M. A specimen, labelled Bangalore, in the British Museum, from Watson's collection.

H 57. 1 β. **Spindasis vulcanus vulcanus,** F. H 57. 2. **Spindasis schistacea,** M.	Throughout the year. Common: especially from May onwards after the rains begin.

H 57. 6 β. **Spindasis ictis ictis,** Hew. In most months of the year. Rather local; but abundant from July to September where it occurs. The last two commonly taken on the roads; *ictis* usually on flowers, e.g. acacia.

H 57. 7 β. **Spindasis elima elima,** M. Rare; I took two specimens flying with *ictis* on acacia.

H. 57. 13. *a*. **Spindasis lohita Pazularia,** M. One ♀ taken in Banerghatta Lac Reserve in September 1927. Though September is definitely a wet month in Bangalore, this specimen, a small one, was of the dry season type.

H 58. **Zesius chrysomallus,** Hub. Flies throughout the year, where it occurs. Local in its habits, depending on the presence of red ants.

H 60. 18. **Tajuria jehana,** M. Obtainable in most months of the year. Plentiful in certain jungles on acacia flowers in July and August. Localized and gregarious about certain trees.

H 60. 3 *β*. **Tajuria cippus cippus,** F. Throughout the year; more generally distributed than the last. Not gregarious.

H 76. **Rathinda amor,** F. There appear to be several broods in the year. Abundant in some jungles in July-August on certain trees and bushes, e.g., on *Eugenia jambolana.*

H 77. 1 *a*. **Horaga onyx cingalensis,** M. One recorded by Col. Winckworth in January 1927.

H 83. 1 *γ*. **Deudoryx epijarbas epijarbas,** M. Common and general. In all months of the year except the driest, i.e., February, March, April. Plentiful in the rainy months on flowers, e.g., sandal, milk-thorn (spurge) etc.

H 84. 1. **Virachola isocrates,** F. Throughout the year both in Bangalore and outside, especially where guavas and pomegranates grow.

H 84. 2 *a*. **Virachola perse ghela,** Fruh. Not taken in Bangalore; rare in the jungles; taken near Arkavati River and in Kormangala State plantation.

H 85. 11 *a*. **Rapala varuna lazulina,** M. Not common in the area.

H 85. 12. **Rapala schistacea,** M. Throughout the year and general; common.

H 85. 16. **Rapala melampus,** Cr. Throughout the year and general. In my experience the most plentiful Rapala in this area.

I. HESPERIDÆ.

I 1. 16. **Hasora alexis alexis,** F. Throughout the year and general. Very common.

I 5. **Badamia exclamationis,** Fab. At most seasons. In July. Sometimes abundant: e.g., on the flowers of divi-divi.

1 20. 2 *β*. **Coladenia indrani indra,** Evans. Rather rare and local. Seen and taken in two jungles only in July-August.

[*Coladenia dan dan*, F. did not appear.]

I 21. 1 *β*. **Sarangesa sati hopkinsi,** Evans. I took one specimen and missed another in a nullah near Oorgaum (Kolar Gold Fields). Mr. Marcon took one in a nullah, eight miles from Bangalore, on the Mysore road. This small fly was difficult to spot. It settled on dry stones and by its coloration was almost indistinguishable from the stone on which it settled.

I 26. 1. **Caprona ransonnettii ransonettii,** Fd. One specimen, apparently W.S.F., taken in July about 20 miles from Bangalore. Small, and differs from W.S.F. type in these particulars (1) spotting above much more extensive, (2) cilia, fw. and hw, distinctly chequered, (3) unf and unh white with markings and spots clearly defined. From a comparison with specimens in the British Museum appears to be *C. ransonnettii lanka, nov.* [Evans].

I 27. *γ*. **Gomalia elma albofasciata,** M. Occurs all the year round in the old cemetery, Madras Road. Not seen outside.

I 28. 2. **Syrictus galba,** F. Throughout the year, common.

I 42. 1. **Ampittia dioscorides,** F. Recorded in most months of the year. Fairly common.

I 47. 1 β. **Suastus gremius gremius,** F. At all seasons of the year. Common.

I 57. 1. **Udaspes folus,** Cr. Occasional both in Bangalore and outside. By no means common. Recorded in July, August, September, October and February.

I 83. 33 a. **Halpe egena ceylonica,** M. Recorded by Col. Winckworth.

I 88. 2 β. **Taractrocera mœvius sagara,** M. Recorded in all seasons of the year. At times common.

I 89. 3 a. **Oriens gola goloides,** M. One taken in May 1926 by Col. Winckworth in Bangalore.

I 91. 1 a. **Astycus augias augias,** L. At times common; generally distributed. Recorded from July to January.

I 91. 2 γ. **Astycus pythias lanka,** Evans. Throughout the year. Common.

I 97. 14 β. **Baoris kumara kumara,** M. Apparently rare near Bangalore. Only one recorded from Banerghatta jungle, August 1927.

I 97. 24 a. **Baoris conjuncta narooa,** M. Recorded by Col. Winckworth in Bangalore. July to September, 1926.

I 97. 31 β. **Baoris mathias mathias,** F. Very common. Throughout the year. No record of *var.* agna in Bangalore or neighbourhood.

I 97. 32 β. **Baoris guttatus bada,** M. Common. Most months of the year.

I 97. 33 β. **Baoris zelleri cinnara,** Wallace. Throughout the year. Common.

[1]ADDITIONS TO THE DRAGONFLY (*ODONATÆ*) FAUNA OF INDIA WITH DESCRIPTIONS OF NEW SPECIES.

BY

F. C. FRASER, LT.-COL., I.M.S., F.E.S.

(*With 4 text-figures*).

During the past three years considerable material has been sent to me by Messrs. H. V. O'Donel, Chas. Antram and Capt. Cardew and this has been further added to by collections made by myself in the Western Ghats. I have to thank these collectors through whose disinterested efforts so much has been added to our knowledge of the dragonfly fauna of India.

Amongst this material quite a number of new species have come to light of which nine have already been described by myself in the Records of the Indian Museum, Vol. xxxiii, pp. 443-474 (1930), but other new ones yet remain to be described as well as new records to be given. In the present paper I have furnished descriptions of two new species as well as those of two females which were hitherto unknown. I am also able to give amended descriptions of rare or little known species whose original descriptions were faulty or imperfect owing to their having been made from teneral or imperfect specimens.

AMPHITHEMIS VACILLANS Selys.

From the Maraghat Forest, Duars, Bengal, Mr. O'Donel has secured a male specimen of that great rarity *Amphithemis vacillans* Selys, and as the insect is fully adult, I am now able to give its mature colouring.

The type as well as the cotypes were subadult and are described as having the thorax yellow and the abdomen with yellow markings; in the specimen before me there are no traces of such, the whole insect is glossy coal-black including the thorax, abdomen and legs. Segments 2 and 3 of the abdomen are pruinosed chalky white on the dorsum and sides with the exception of a small uncovered cordate area on the dorsum at the apical border and the middorsal carina on segment 3 which is finely black. All wings are tinted with pale yellow at the extreme base only; the venation is as given by Dr. Ris except that there are two traversing nervures in all the bridges and one of the discoidal cells in the hindwing is traversed once.

The white basal abdominal segments compare with the red ones of *A. mariæ* Laid., and are evidently recognition sexual markings in both species. The type comes from Bhamo, Burma; the present specimen was taken on 24-10-31.

CAMACINIA GIGANTEA Brauer.

Originally described from Amboina, the only record for the Indian Empire was Burma. Mr. Chas. Antram has now discovered this insect at Nowgong, Assam and has sent me some 17 males and a female. The males are all adult and they differ slightly from type by the basal coloured portion of wings extending distad the endings of *IA* and *MA*. The brown fascia also is continued outwards as far as the apices of wings limited posteriorly by *Rii*. The species is apparently common at Nowgong.

MACROMIA MINIATA Fraser.

Amongst the material collected by Mr. H. V. O'Donel in the Duars are five specimens of *Macromia miniata* Fras. The discovery of this species so far north comes as a great surprise as it was hitherto unknown outside the small province of Coorg. The female was unknown, and as two of the Duars specimens belong to this sex, I am now able to furnish its description:—

Female.—Abdomen 43 to 45 mm. Hindwing 38 to 40 mm.

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[1] Received for publication on 16th. August, 1932.

Resembles the male closely in colour and markings, differing only by the stouter and more evenly cylindrical abdomen. The labrum in both specimens is bright citron yellow at the base, thus differing from the type male; there is also a large spot of the same colour on the bases of mandibles. Markings of thorax and abdomen are exactly similar to the male. Wings saffronated at extreme base and the whole more or less deeply enfumed brown. In one specimen this brown takes the form of a net-work corresponding to the wing reticulation, the cell-middles being hyaline and uncoloured. One specimen has an incomplete basal antenodal nervure in one of the forewings, a structure rarely seen in the genus; nodal index.— $\frac{7-15}{10-11} \Big| \frac{15-7}{11\ 10}, \frac{6-18}{8-11} \Big| \frac{17-7}{12\ 9}$.

Distribution.—Huldibari Tea Estate, 20-7-31 and 7-8-31, and 8-5-32. One of the males has the labrum bright yellow at the base but apart from this, is true to type including the genitalia.

TETRACANTHAGYNA WATERHOUSEI MacLach.

Male.—Abdomen 55 mm. Hindwing 50 mm. Anal appendages 6 mm.

Head.—Labium warm brown; labrum, clypeus and anterior surface of frons olivaceous green tinged with ochreous below, upper surface of frons blackish brown, behind eyes yellow. Head of enormous size, eyes globular and very broadly contiguous, occiput nearly obsolete, frons slightly elevated.

Prothorax and thorax blackish brown marked with bright greenish yellow as follows:—oblique antehumeral stripes converging strongly and pointed above, a small yellow point near the middle line and close to the antehumeral sinus, two lateral oblique, rather narrow stripes, the anterior parallel and close to the humeral suture, the posterior broader, covering the middle of the metepimeron; small yellow spots on the coxae and some on the tergum. Legs black but the proximal three-fourths of all femora reddish brown.

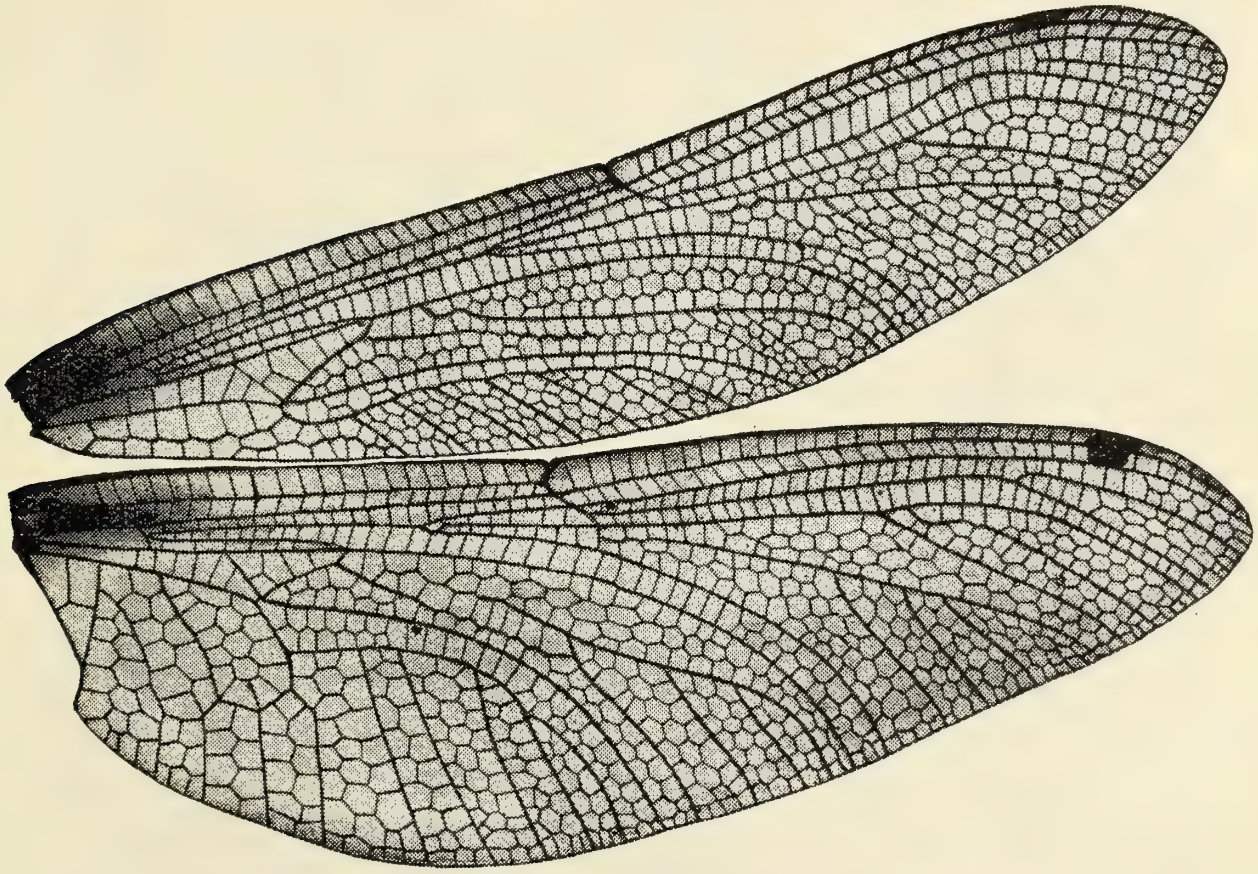


FIG. 1.—Wings of *Tetracanthagyna waterhousei* ♂ MacLach.

Wings hyaline, enfumed dark uniform brown in one very adult male, and in all, bearing a diffuse dark brown ray in the costal, subcostal and median spaces near the base, gradually fading out towards the discoidal triangles.

The hindwing 16 mm. broad at the level of the inner end of bridge, base of same wing rather contracted and oblique, tornus moderately prominent. Discoidal triangles 6 to 8-celled in the forewings, 5 in the hind; 6 to 7 cubital nervures in forewings, 5 to 7 in the hind; anal loop 12 to 17-celled; hypertriangles traversed 7 times in the forewings, 5 to 6 in the hind; anal triangle 3-celled; a well-developed supplement to the discoidal triangles; 3 to 4 rows of cells between the forking of *IRiii* and *Rspl* and *MA* and *Mspl;* 3 to 5 rows of cells between the forks of *IRiii;* nodal index.— $\frac{23\text{-}31}{26\text{-}19}\Big|\frac{28\text{-}23}{22\text{-}27}$, $\frac{21\text{-}27}{24\text{-}19}\Big|\frac{29\text{-}22}{19\text{-}22}$; pterostigma of forewing covering 3 cells, short, distal and proximal sides oblique, 3 times as long as broad; that of hindwing shorter, only 2½ times as long as broad and *with the two proximal cells beneath it opaque brown* so that the pterostigma looks irregularly quadrate; membrane white, very short.

Abdomen black; segments 2 to 8 with narrow basal blue annules and a pair of narrow dorsal green apical lunules; segment 1 reddish; segments 9 and 10 unmarked, the former segment with a robust spine terminating the middorsal carina at apex, the latter with a robust dorsal keel. Oreillets small but prominent, greenish yellow on dorsum margined with a row of minute teeth.

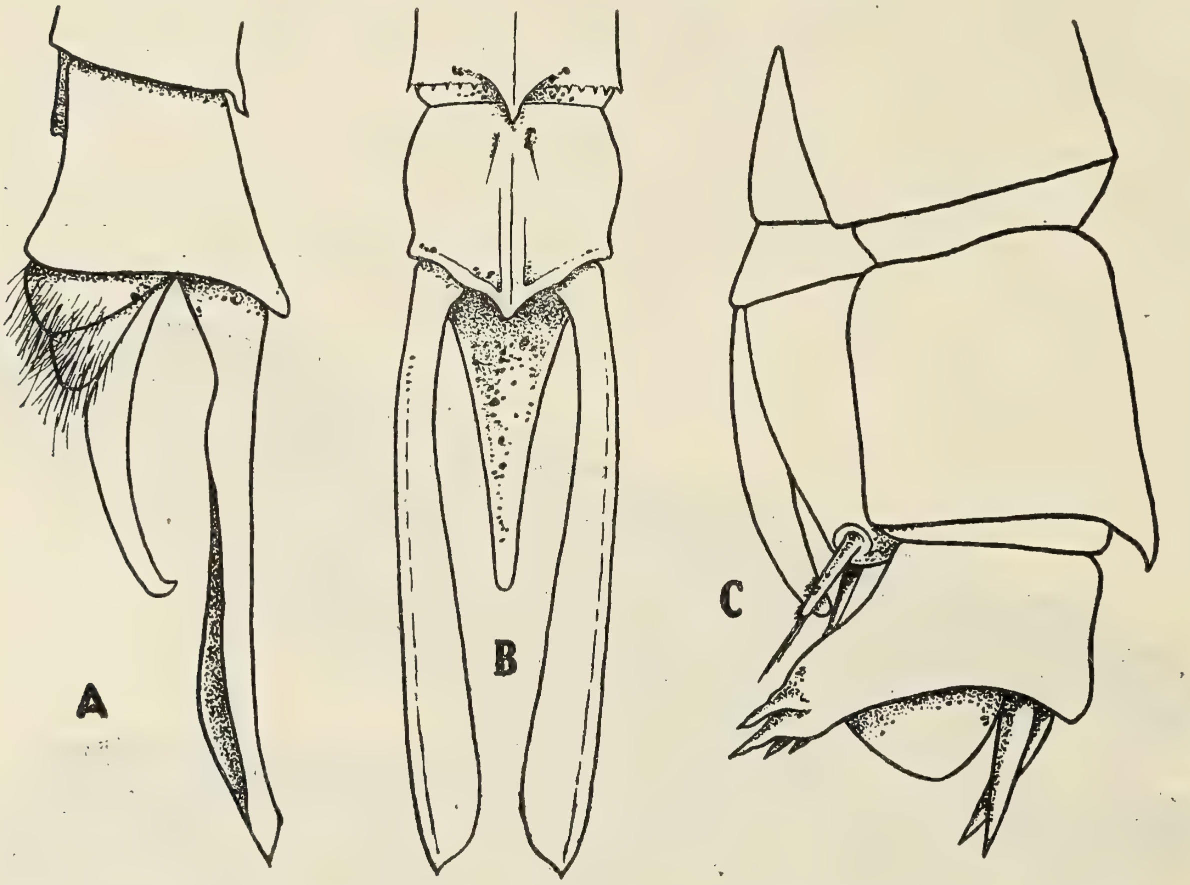


Fig. 2.—(A) Anal appendages of *Tetracanthagyna waterhousei* MacLach. ♂ viewed from the left side. (B) Anal appendages seen from the dorsum of same ♂. (C) Terminal segments, dentigerous plate and ovipositor of same ♀.

Anal appendages black; superiors as long as segments 9 and 10 taken together, narrow, lightly constricted near base, after which is a small ventral dilatation, apices ending in a minute outer spine and broadened slightly; a keel running the whole length of appendages parallel to and near the outer border; inferior appendage narrowly triangular, apex curved up, hollowed out beneath, rather more than half the length of superiors.

Female.—Abdomen 52 mm. Hindwing 56 mm.

Similar to the male in colour and markings but the basal segments of abdomen dark reddish brown at their middles. Differing by the shorter stouter and more cylindrical abdomen which tapers as far as segment 7 and then dilates again towards the anal end, the end segments being markedly compressed. Segment 9 with a similar apical dorsal spine, segment 10 produced below to form a robust genital plate which is usually furnished with 4 stout spines (but in one female 6 are present); ovipositor very robust, ending just prior to the genital plate; anal appendages cylindrical, pointed at end.

Wings similar to the male but in some, a distinct broad pale brown fascia crossing both wings at the level of the pterostigma, which latter is longer than in the male and has not the opaque cells beneath it in the hindwing noted in the case of the male; nodal index.— $\frac{24\text{-}29}{24\text{-}18}\Big|\frac{31\text{-}22}{19\text{-}24}$; 6 to 7 cells in discoidal triangles of forewing, 5 in the hind; 6 to 7 cubital nervures in forewings, 6 in the hind; anal loop 15 to 16-celled; other details similar to the male.

Distribution.—Maraghat Forest, Duars, Bengal. Three males and two females taken by Mr. H. V. O'Donel. Mr. O'Donel states that this insect is crepuscular in its habits, coming out in forest well after sunset and continuing flying until it is too dark to see them. He has however seen them during the day, when they are fairly common in heavy forest but are difficult to catch as they fly very high until it grows darker, when they descend to within reach of the net. This species is synonymous with *Taoaeschna fontanalis* Förster and also with *Aeschna quadrilateralis* mihi, the latter described from an incomplete specimen with the terminal five segments missing. The present specimens differ from type by their much smaller size and also by having the labrum greenish yellow instead of black. Mr. D. E. Kimmins of the British Museum informs me however that this latter feature may be due to postmortem changes, after having made a re-examination of the type. The unique shape of the pterostigma in the hindwing of the male and its variability from that of the forewing, and all wings of the female was not commented on in the original description. The type comes from Borneo and this is the first record of the genus from Indian limits.

The shape of the genital plate in *Tetracanthagyna* is clear proof that the female deposits her eggs in dry earth after the manner of *Gynacantha* and *Aeschna erythromelas* Mac L., and in view of the shape of the genital or dentigerous plate of the latter, totally different from the same structure found in genus *Aeschna*, it seems preferable that *A. erythromelas* should be given generic rank and for this I propose the name of *Polycanthagyna*. *Tetracanthagyna*, *Triacanthagyna*, *Platacantha*, *Gynacantha*, *Polycanthagyna* and perhaps *Cornacantha* form a group characterized by the specialization of the dentigerous plate of the female which is fitted to enable the insect to oviposit in dry soil; most of the known species are moreover crepuscular in habit; probably all will be found to be so when we have learnt more concerning their habits.

AESCHNA PETALURA Martin.

The capture of two specimens of this rare insect, of which the male still remains unknown, enables me to give its full colouring, as one at least, has preserved its original markings with exceptional beauty.

Face olivaceous; frons bright yellow above but brownish black towards and at the base, this brown passing forwards in the sulcus to join the brown on front of frons. (The T-mark noted by Martin is not especially noticeable in these specimens.) Occiput yellow.

Prothorax and thorax warm brown marked with azure blue; short, thick antehumeral stripes not extending the whole length of dorsum and gradually broadening below, the antealar sinus, spots at the bases of wings and along middle of tergum, and lastly two broad lateral stripes, the latter of which covers most of the metepimeron. Legs black, bases of femora reddish brown.

Wings hyaline, tinted with brown throughout except for a space at the base, the outer margins of which fall just distad the discoidal triangles and loop, the brown colour densest on the nervures, the cell-middles clear. Anal loop with 10 to 12 cells; nodal index.— $\frac{11\text{-}21}{14\ 15\text{-}}\Big|\frac{20\text{-}13}{13\text{-}15}$, $\frac{12\text{-}18}{12\text{-}12}\Big|\frac{16\text{-}12}{12\text{-}14}$: pterostigma short, covering 2 to 3 cells, dark brown, braced; *IRiii* forked well before the level of pterostigma and with 2 to 3 rows of cells between it and *Rspl.*

Abdomen dark brown marked with bright grass-green as follows.—segment 1 with a middorsal triangular spot, broadest at the apical border of segment, the sides also broadly green; segment 2 with a middorsal stripe extending from the dorsal spot on segment 1 and tapering to a point which ends short of apical border of segment, a pair of green lunules on the apical side of jugal suture, the sides broadly green and a pair of azure blue apical lunules; segments 3 to 7 with a tiny middorsal basal triangular green spot, a pair of large lunules bordering the jugal suture distally and a pair of apical lunules; segment 8 with the apical lunules only; segment 9 with a large oval spot on each side, whilst segment 10 is unmarked; all segments from 3 to 8 have also a large latero-basal spot of green.

Anal appendages dark brown, shaped like the paddle of a canoe; vulvar scales broad and massive; dentigerous plate rounded below, typically Aeschnine in shape, coated with numerous minute spines beneath.

Two females collected by C. M. Inglis at Phulloth, Sandakhpura, Sikkim, 11,500 ft. 16-10-28. The enormous altitude at which these were taken perhaps constitutes a record for dragonfly life, although Mr. T. B. Fletcher has picked up a dead *Aeschna mixta* above the snow line in Kashmir; it was actually lying dead in the snow!

CHLOROGOMPHUS OLYMPICUS sp. nov.

Male.—Abdomen 55 mm. Hindwing 40 mm.

Head.—Labium pale ochreous; labrum olivaceous changing to dark brown outwardly and with a minute black medio-basal point; anteclypeus greenish; postclypeus and frons bright grass-green, the former narrowly margined with blackish brown below, the latter with a narrow blackish brown stripe shaped like a cupid's bow lying midway between the crest and lower border of frons; the base of frons above dark reddish brown; vertex and occiput black, the latter fringed with long golden hairs.

Prothorax black with a small spot on each side and the narrow posterior lobe bright yellow.

Thorax black marked with bright greenish yellow as follows:—narrow antehumeral stripes, pointed below but greatly broadened above and converging so as to be separated only by the narrow black middorsal carinal suture; laterally two moderately broad stripes, one on the mesepimeron, the other covering most of the metepimeron; between these two a small but conspicuous upper spot; beneath brown marked with a mid triangle of black. Legs black, coxæ pale brown.

Wings hyaline, narrow; pterostigma black, covering 2 to 2½ cells; discoidal triangles of similar shape in fore and hindwings, usually entire but occasionally traversed once in the forewings; supratriangles traversed twice, occasionally three times in the forewings; 6 to 7 cubital nervures in the forewings, 5 in the hind; 1 median nervure to all wings; a single row of cells between the origins of *IA* and *Cuii* in the hindwing; anal triangle 3-celled; nodal index.—

$$\frac{9\text{-}18}{12\text{-}12}\left|\frac{19\text{-}9}{14\text{-}11}\right.$$

Abdomen much longer than wings, tumid at base, constricted at segments 3 and 4, then dilated again at base of 4 but still narrow and triquetral in section till the anal end. Coloured black marked with bright citron yellow as follows:—segment 1 clothed thickly with yellow hairs, a yellow spot on dorsum, a smaller one at each side and a narrow apical line on the sides; segment 2 with the small oreillets yellow, a pair of postjugal triangular spots narrowly separated on the dorsum, but narrowly confluent with a pair of very large apical lunules which are confluent over the dorsum, the posterior two-thirds of the ventral border narrowly yellow and a prolongation from this yellow running up the margin of the segment to become confluent with the apical lunules (A large black fleur-de-lis is thus cut off and enclosed by the yellow on the dorsum of segment); segment 3 with a pair of large apical lunules broadly confluent over the dorsum, a pair of small triangular spots lying just basad the jugal suture and separated by it from a pair of elongate triangular postjugal spots which extend nearly to the apical lunules; segments 4 and 5 with a pair of postjugal triangular spots and a pair of broadly confluent apical lunules; segments 6 and 7 with rather broad apical rings slightly indented by the black on middorsum; segments 8 to 10 with very narrow apical rings confluent below with a narrow ventro-lateral stripe, the ring on segment 10 interrupted above and also invading the black subdorsally.

Anal appendages black, of equal length; superiors twisted on themselves longitudinally as seen in profile, shallowly bifid at apex, and with a robust ventral spine at mid length; gently curved towards one another as seen from above; inferior rather broadly and shallowly notched at apical border, the outer angles turned up and ending in a pair of minute spines. Female unknown.

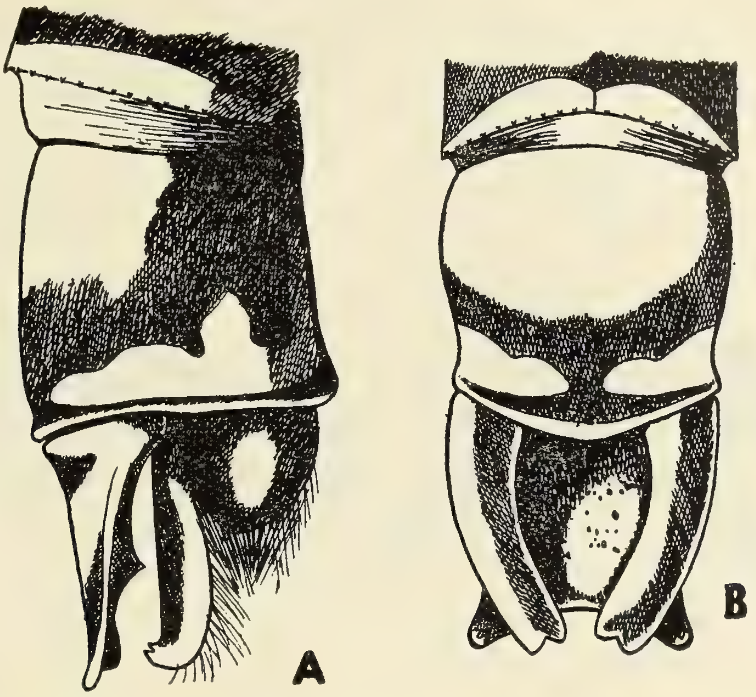


Fig. 3.—Anal appendages of *Chlorogomphus olympicus* sp. nov. ♂. (A) viewed from the right. (B) viewed from the dorsum. (*Drawn from the type.*)

Distribution.—Kufri, Simla States, 8,400 ft. 9-6-29. A single male, the type, now in the author's collection, taken by Capt. Cardew. This species belongs to the *atkinsoni-selysi* group and is readily distinguished by the broad extent of the abdominal markings, it being the only known species in which segments 9 and 10 are marked. Other distinguishing features are the entire discoidal triangles, the bright grass-green face, the frons with the highly characteristic cupids-bow stripe at its mid front aspect, etc. Seven species are now known from within Indian limits.

ANAX IMMACULIFRONS Rambur.

A single male collected by Capt. Cardew in the Kangra Valley, 29-4-30. Although common in the Western Ghats and Ceylon and less so in parts of the Agency Tracts, this insect is extremely rare in the north, the present occurrence being the third only which has come to my notice. It differs in no respect from southern specimens.

MESOGOMPHUS LINDGRENI Fraser.

Mr. O'Donel has taken two more males of this beautiful species known hitherto only from a single male taken at Turzum, Darjeeling District. In comparing these two specimens with the type I note that the dorsal black markings enclose inverted figures of 7 of the green ground-colour and that this is true also for the type. In the figure given on Plate II, Journ. Bom. Nat. Hist. Soc., Vol. xxix, facing page 1001, the ground-colour is shown, in error, interrupted. One of Mr. O'Donel's specimens has preserved its original colours almost perfectly and it is to be noted that this is a beautiful grass-green with jet-black markings. Another important feature comes to light, and that is the presence of an incomplete basal antenodal nervure in all wings. This is constant in all wings of all three specimens and as this character is quite unknown in all other species of the genus, it forms an important guide to identification. One of the three specimens will be deposited in the British Museum.

COELICCIA DOROTHEA sp. nov.

Male.—Abdomen 35 to 38 mm. Hindwing 22 to 23 mm.

Head.—Labium pale yellow; labrum glossy black as also the ante- and post-clypeus; bases of mandibles, genae and a streak running inwards on the frons but not confluent across the middle line, azure blue; rest of head black marked with a small oval spot of blue on the outer side of the ocellar space and a pyriform blue spot on each side of the occiput.

Prothorax black with a large azure blue oval spot on each side the middle lobe; posterior lobe large, trilobate.

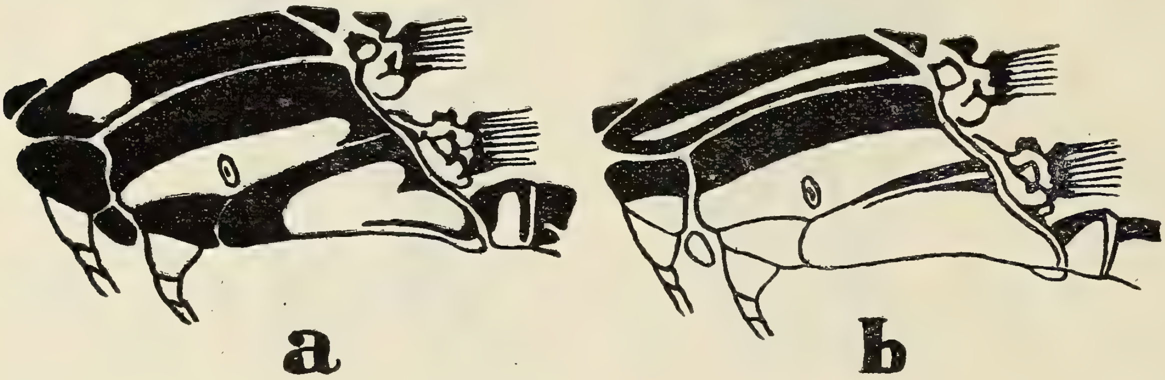


FIG. 4.—a. Thoracic markings of *Cœliccia dorothea* ♂ sp. nov.
b. Thoracic markings of *Cœliccia dorothea* ♀ sp. nov.

Thorax black on dorsum marked with a large azure blue oval spot on the anterior or lower half; laterally azure blue with a narrow black stripe on the postero-lateral suture broadening forwards above and more so posteriorly below; beneath pale blue to white, the black of sides encroaching on the anterior part.

Legs white, femora black on flexor and extensor surface, tibiae on the flexor surface.

Wings hyaline, palely enfumed in old specimens; pterostigma black framed in thick black nervures which are margined inwardly with white or palest brown, nearly quadrate but the sides oblique, covering $1\frac{1}{2}$ cells; *Riv+v* arising at the level of the nervure descending from the node, *IRiii* well distad of that level; 16 to 18 postnodal nervures in forewings, 16 to 17 in the hind. (In one male only does *Riv+v* arise slightly proximal to the subnodal nervure.)

Abdomen black marked with azure blue or white as follows:—segment 1 broadly white laterally, this extending on to dorsum along the apical border; segment 2 similar but the apical extension cut off to form a pair of small subapical subdorsal blue spots; a fine middorsal carinal white line extending from base for half the length of the segment; segments 3 to 6 with a pair of subapical subdorsal spots; segments 7 to 9 unmarked; segment 10 creamy white except for a small dorsal basal triangular black spot.

Anal appendages creamy white, subequal; superiors but a shade longer than inferiors, ungulate and pointed obtusely at apex, with a broad ventral spine which ends in a minute black point directed backwards; inferiors forcipate, broad at base, then cylindrical and very sinuous, the apical portions turned strongly in and blunt at apex which however has a minute black point at its extremity. Penis not differing markedly from that of *C. albicauda* Forst., broad at apex, with a spine below the curled over portion, which latter is bifid, its two long branches curling strongly downward to embrace the stem of organ.

Female.—Abdomen 32 to 34 mm. Hindwing 22 mm.

Differs in several respects from the male.

Head.—Labrum yellow suffused with blackish brown at base; bases of mandibles, genae and the prolongation inwards on the frons yellow, the latter narrowly confluent across the middle line; ocellar blue spots prolonged as a zigzagged stripe as far as eyes including the penultimate segment of antennae; posterior occipital spots yellow. Prothorax almost entirely yellow with a narrow anterior collar and the posterior lobe black, the latter lobe much aborted, almost obsolete. Thorax black on dorsum with rather broad, strongly curved azure blue antehumeral stripes extending for nearly the whole length of dorsum; laterally pale blue with a very fine black line on the postero-lateral suture incomplete below. The blue ground colour invading the dorsal black above near the antealar sinus; beneath pale yellow, unmarked. Legs yellow marked as in the male. Wings not differing in any respects from those of the male.

Abdomen black marked with pale yellow or blue; segment 1 broadly yellow, its dorsum rather narrowly black; segment 2 similar to the male but the subapical spots confluent with the yellow on sides; segments 3 to 5 with paired subapical spots confluent with the yellow on the sides; segments 6 to 7 unmarked; segment 8 with its apical half pale blue, the basal black projecting as a strong point into it on the middorsum; segment 9 entirely pale blue on dorsum, this blue narrowiing gradually from base to apical border; segment 10 and the short conical anal appendages black; vulvar scales yellow tipped with blackish brown, very robust.

Distribution.—Huldibari Tea Estate, Duars, Bengal. Five males and two females collected by Mr. H. V. O'Donel, 30-8-31 and 30-10-31.

Laidlaw in his recent monograph on the genus (Rec. Ind. Mus., Vol. xxxiv, pp. 7-42, 1932) has split up the genus into 3 groups by the relationship of *Riv+v* and *IRiii* to the nervure descending from the node, and these groups are further subdivided by the number of cells existing between the outer end of the discoidal cell and the nervure descending from the node. This new species falls into Group 3 and into the last category of that group where only 2 cells are found between the discoidal cell and the subnodal nervure. Only one other species, *C. albicauda* Forster, is known to belong to this group-section and from it *C. dorothea* is easily distinguished by the presence of a single pair of blue dorsal thoraic spots instead of two pairs as in *C. albicauda.* Moreover the spot is broadly oval and large instead of small and triangular; segment 10 in the male is entirely creamy white instead of black marked with white; the prothorax has the black more extensive in the male but less so in the female; the female is distinguished by the broad blue antehumeral stripes as well as by the dorsum of segment 9 and the apical half of 8 azure blue. That the two species are closely allied however is clear from the positions of *Riv + v* and *IRiii*, as well as by the similarity of the male anal appendages and penile organ. Forster's species comes from the Malay States.

A pair of this beautiful new species will be deposited in the British Museum.

AGRIOCNEMIS ARBORENSE Laidlaw.

A pair of this rare insect has been sent me by Mr. H. V. O'Donel from Huldibari Tea Estate, Duars, Bengal, taken on 22-10-31. The female was hitherto unknown and is described below. The type is in the Indian Museum, from Dibrugarh, and I possess specimens from Nowgong, Assam, collected for me by Mr. Chas. Antram.

Female.—Abdomen 22 mm. Hindwing 15 mm.

Head.—Labium white; labrum glossy black narrowly bordered with blue; anteclypeus black; genae, bases of mandibles and post-clypeus azure blue, rest of head black with a pair of large bright blue postocular spots.

Prothorax black with a large blue dorsal spot on the anterior lobe; posterior lobe squared behind.

Thorax black as far lateral as the antero-lateral suture, marked on dorsum with narrow antehumeral azure blue stripes; laterally blue with a narrow black stripe on the postero-lateral suture.

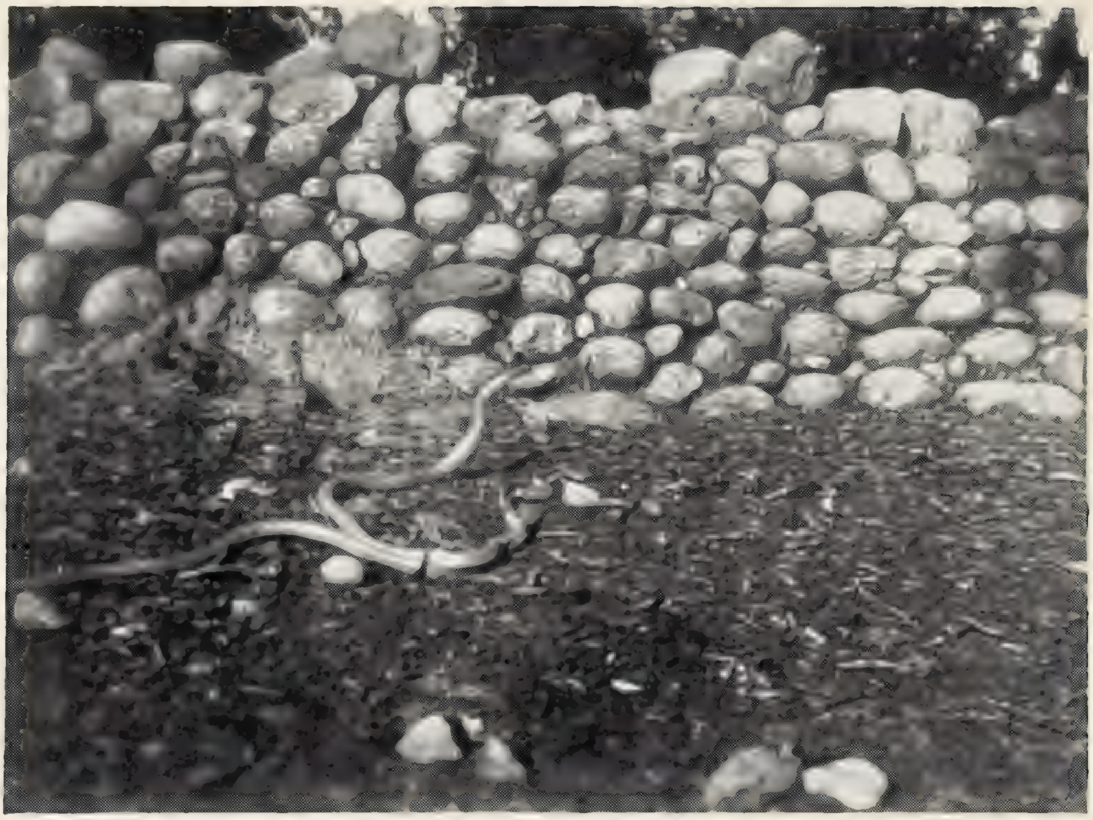
Legs pale yellow, femora broadly black on extensor surface.

Wings hyaline, pterostigma black framed finely in palest brown, covering 1 cell; 9 to 10 postnodal nervures in forewings, 7 in the hind, Abdomen black marked with azure blue as follows.—Segment 1 with a large spot on each side and a narrow intensely blue apical annule; segment 2 with a narrow lateral stripe, which is shaped like a '?' mark at the apical end; segments 3 to 6 with a long lateral narrow stripe which is interrupted apicad on segment 3; segment 7 with only a basal-lateral spot; segments 8 to 10 unmarked but the intersegmental nodes blue. Anal appendages dark blackish brown, very small and conical; vulvar scale yellow.

Along with these specimens and from the same locality, were representatives of *Agriocnemis femina*, *pygmaea*, *clauseni* and *lacteola* and three species of *Pseuadagrion*,—*P. microcephalum*, *P. bengalense* and *P. spencei*. The latter is the rarest of our Indian Pseudagrions and of the four males in this collection, two have a well-marked triangular black dorso-basal spot on segment 8, thus differing from the type in which this segment is entirely blue.

ALLOPHAEA OCHRACEA Selys.

Fairly common in the Maraghat Forest, Duars. The specimens are all very small and the males differ amongst themselves in the depth of the black clouding the orange area in the hindwing. The darker varieties might be described as *A. brunnea*, the lighter or paler ones as *A. ochracea*. Collected on 16-8-31.



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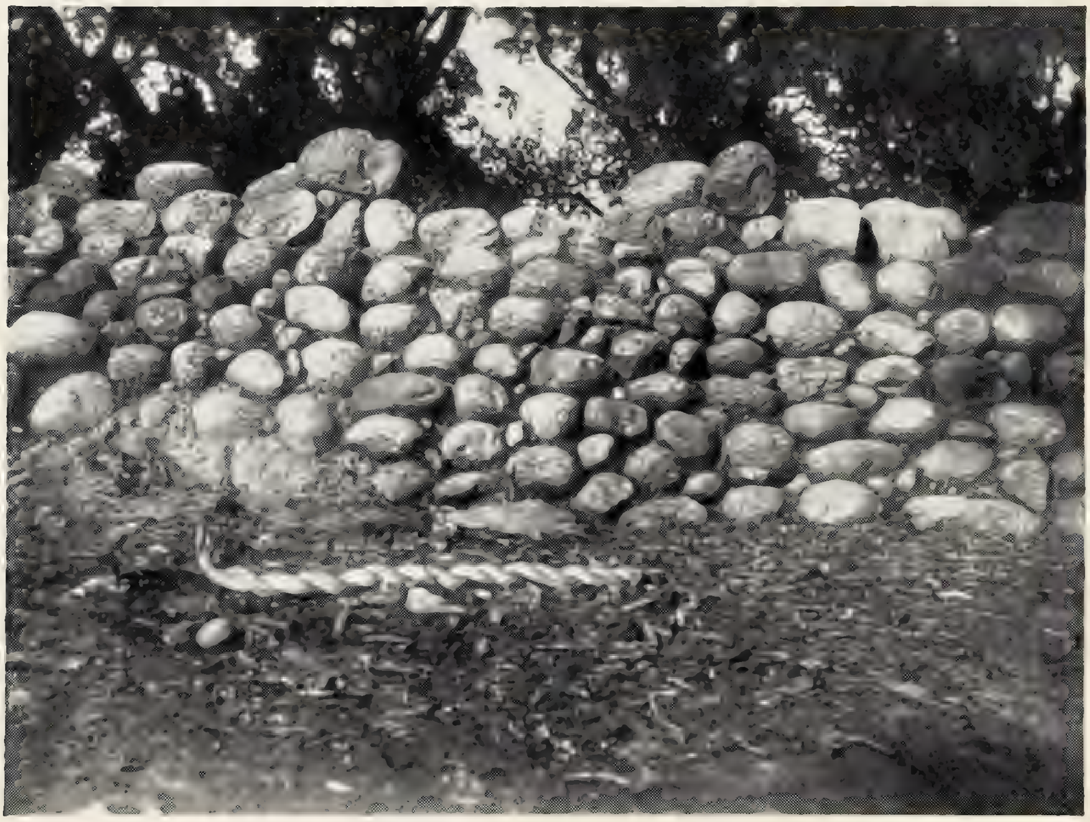

2.

Dhamans or Rat-Snakes Mating.

THE SOCIAL LIFE OF SNAKES.

BY

S. H. PRATER, M.L.C., C.M.Z.S.

(*Curator, Bombay Natural History Society*).

The belief is widely prevalent in India that if a Cobra is killed in a house or compound its mate inevitably turns up sooner or later at the same spot and assumes an aggressive attitude.

The *Field* recently printed an extract from the *Cornhill Magazine* relative to this belief. The author of the article Mr. J. H. Knowles says "The instinct, which seems to be peculiar to this variety of snake only, (i.e. cobras) is a wonderful thing. I would naturally be surprised that the direction taken by one of a pair or its whereabouts, after it had wandered at random from its abode in search of prey, could be known to its mate—an uncanny sense of smell might give us an explanation, but after a lapse of days, which is usually the case before the living snake finds the spot where its mate was killed, it would be logical to presume that all traces of the missing snake had disappeared. I have disinfected carefully a whole room in which a cobra had been killed, yet the mate has come to the precise spot".

I remember reading in a local paper an account of the killing of a python. The snake was dragged home over a considerable distance and left in a compound. The next morning a second python was discovered near the spot where the dead snake was lying. It would appear that occurrences of this nature are not confined to Cobras only, and it would be interesting to learn whether any readers of this Journal know of similar cases.

If the facts are correctly reported and if there is a foundation for this belief—and there is is generally a substratum of truth underlying such general and widespread beliefs, the question arises why and how does a snake trace its mate?

In answering the question we must first of all dismiss the popular explanation which ascribes to the living snake an aggressive desire for vengeance. It is the natural and usual conclusion arrived at by falling back on human experience. We are accustomed to attribute to the animal motives and the corresponding behaviour which a human being may display under similar circumstances. Assuming that the living snake is of the opposite sex to the one which was killed (and we have to assume this, as we know of no records where the sex or sexes of the snakes were ascertained), one would first ask are snakes social animals? Do the male and female of the species live in association and if so is this association permanent or is it limited to a more or less definite period? If limited, when and how is this association affected? How do the sexes come together? We are accustomed to interpret social life among animals in terms of a number of individuals living in a colony, mutually dependent on each other for their well-being or even their existence. But this is only one of the many phases of social life. No living being is solitary. All animals are compelled, if only for a brief moment, to contract an intimate union with some other individual of the species. All animals are therefore at some time of their lives immersed in some society since the social medium is a condition necessary to the renewal of life. Moreover, from the lowest to the highest animals, we detect in the development of the social habit a progression which if not uniform is at least constant. Each group of animals carries the social habit further in one direction or the other. Varying stages of social life are exhibited. This life in common may be limited in one group of animals to a brief union of the sexes. The association may continue in another class till the eggs or young are produced. It may go further in another group of animals to care of the eggs or offspring by one or both parents. It may be extended to the continued and permanent association of the parents after the young have been raised, and finally in other groups, as for example in insect societies to the establishment of family life—to the more or less permanent association of parents and offspring. This is its culminating point. A point reached by different channels of evolution, so far, only by man and the social insects.

Now association between individuals of a species may be brought about in two ways. There is the form of social life which is based not on the mutual attraction of the individuals associating but which is brought about by factors and stimuli which are purely external. There are various factors, ephemeral or constant which tend to bring about such associations—suitability of the environment, propinquity and abundance of food supply, climatic conditions of some of them.

We know that the Common Blind Snake (*Typhlops brahminus*) is occasionally gregarious. Colonies of these snakes are found living in rotting wood. The basis of the association is not mutual attraction but presumably the attraction provided by the presence of the eggs and larvae of insects on which these snakes feed and which are found abundantly in rotting wood.

Again one may discover a number of snakes living in the neighbourhood of a bungalow. Cobras and Dhamans are frequently found in such situations. Crumbling masonry, a woodstack, accumulations of rubbish afford comfortable quarters but the main attraction of the residence is the propinquity and permanence of the food supply. Rats and the eggs of poultry on which Cobras and Dhamans feed may be found in abundance in the neighbourhood of human habitations.

Then again, among snakes which hibernate during the winter, some species are known to hibernate together in large numbers. In England, it has been observed that all the adders go to earth with the first definite night of frost in October, retiring in holes two to three feet deep or under the roots of trees. Any number upto 30 may be huddled together in one place for their winter sleep—old males, females and young lie together coiled up in knots in their damp retreat. In America, again, Rattle snakes (*Crotalius horridus*) have been found hibernating under the ground together in considerable numbers. It must not be concluded that hibernation *en masse* is exhibited by all species which hibernate. In Northern India, our common Buff-striped Keel-back (*T. stolatus*) hibernates during the cold season—numbers of these snakes, according to Wall, were dug up at Rae Bareilly, U.P. in December. They were found singly at a depth from 9-18 inches below the surface of the soil, chiefly in the roots of giant clumps of grass and when dislodged were dull and inactive.

The second type of association, the type which provides the basis of true social life arises from mutual attraction, from the craving of one individual to live and remain with another individual or individuals of its kind. The stimulus comes from within: it is quite independent of external factors and conditions. Individuals so associating may exchange a favourable for an unfavourable environment in obedience to the urge and to satisfy the craving for a life in common. The association of the sexes during the breeding season is a rudimentary phase of this form of social life. In some instances however external factors may contribute to the maintenance of such an association.

Strangely enough with some species of snakes the breeding season may coincide with the period of hibernation or aestivation. In many parts of India, when real cold weather conditions are established, pythons (*P. molurus*) are known to hibernate. They retire to some convenient retreat and there lie up till the return of the hot weather. Now as the eggs of pythons are laid in May and June, it is concluded that pairing takes place during hibernation, as the females are gravid when the time of hibernation is over. Pairing apparently takes place in the coldest months of the year; in India, during the months of December, January and February. A pair of pythons in the Paris Zoo were observed in union several times during the month of January and February and the eggs were deposited in May; the same month in which eggs are laid in India. Again in the case of the African Python (*Python sebae*), whose habitat lies south of the Equator, where winter conditions establish themselves in mid year, a pair in the London Zoo were observed to mate in June. The eggs were laid in the following January. It is probable that males and females hibernate together and their association is prolonged through the cold weather.

That several pythons may seek the same retreat is instanced in the case reported in the *Pioneer* (February 19th, 1906). Six pythons were discovered in a cavity in the banks of a stream in Mysore and dragged out one by one. They all ranged between 10 and 12 feet. The distribution of the sexes amongst these pythons was not recorded. Wall reports hearing of a similar case in the Himalayas. It seems extraordinary that the sexual impulse should be retained and that pairing should take place at the time of hibernation when the vitality of the snake is lowered and the body heat sensibly diminished and the capability for digestion is impaired. But this is presumably what happens from the facts above recorded.

Now coming to species which aestivate during the dry weather, it is well known that our common Buff-striped Keel-back (*Tropidonotus stolatus*) goes to earth during the dry season. Round Bombay these snakes disappear from the country side during the dry months but are abundant in our fields as soon as the rains break. They come out with the frogs. The period of aestivation is apparently the time when pairing takes place. Judging from what is assumed of the period between coition and the actual deposition of the eggs, (i.e. about 2 months) the sexes must in many instances retire in pairs, as when the rains break, many of the females are already in an advanced stage of impregnation. Other species which aestivate may breed after the period of aestivation is completed. The Checkered Water Snake (*T. piscator*) which goes to earth in situations where the water supply dries up, breeds during the rains.

Apart from the fact that the association between the male and female may be extended by external stimuli, it is assumed that even under normal circumstances the association of the male with the female among snakes may continue for some time after actual union takes place. Blanford speaks of a pair of Checkered Water Snakes which he dislodged from under a stone. He says that they had evidently made their home there and that they showed a disinclination to leave the spot. He remarks that though the snakes were evidently cohabiting the female was in an advanced state of impregnation. Wall records the case of a pair of dhamans discovered disporting themselves in a stream, the female was found to contain eggs in an advanced state of development. Mr. A. Flynn[1] records an instance of a male Russell's Viper taken with a gravid female; seventy-nine days later the female produced her brood of young. Now in the case of the Russell's Viper the period of gestation is definitely known to exceed six months. If the partnership of this pair of vipers commenced with coition it must have extended over half a year.

Two incidents are recorded by Wall[2] in regard to the Cobra.

A Burman in his endeavours to dig out a cobra dislodged two other cobras from the same retreat. Of the three snakes two were males and the third a female, which showed her ovarian follicles impregnated and obviously enlarged. A similar case, again in connection with the Cobra, this time in Ceylon, was reported to Wall.

In commenting on the incident noted by Blanford relative to the association between a pair of Checkered Water Snake (quoted above) Col. Wall in his *Snakes of Ceylon* says 'This with other instances of a similar kind leads me to assume that snakes possess a mutual love and attachment in no way inferior to that exhibited by many warm-blooded animals which preserve their conjugal relationship long after the term of sexual gratification.'

But the question arises are snakes monogamous? In the many cases recorded were the males observed in company with the females their only partners? The finding of a male snake with a gravid female does not imply that the male so discovered is the one responsible for the gravid condition of the female. In short we have no evidence to show that an individual pair continues to live in association after mating takes place. But the evidence so far recorded indicates that the female of the species is sought after by the males after impregnation and during the period of gestation.

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[1] *Journ. Bom. Nat. Hist. Soc.*, xxxvi, p. 271.

[2] *Snakes of Ceylon*, p. 472.

From the instances we have recorded it will be seen that the social life of snakes is limited to the association of the sexes during the breeding season. It is also apparent that association between the males and females may continue thoughout the period of gestation over a term which may be prolonged for many months. It is true that many observers have commented on the cobra's propensity to live in pairs. But there is nothing to show that the partnership is limited to a female with a particular male or that the association is continued beyond the limits of the breeding season. As a general rule cobras pair during the cold weather—December, January and February and the eggs may be deposited during any month between April and August. At any time during this intervening period it may be possible to find cobras living in pairs. Though, from what is so far known from recorded observation of the period of gestation, the term of association between an individual pair if it commenced with the act of union and was continued till the deposition of the eggs would last from 2 to 5 months.

In this association of the sexes during the breeding season we find established among snakes the rudimentary basis of true social life, but the development of the social habit as expressed in the higher and ultimate forms of social life is derived from parental care and from the association of the parents with the offspring.

Parental care is not highly developed among reptiles. No elaborate provision is made for the deposition of the eggs, nor are the young tended after they are born. Rarely is there any attempt at nest-building. Various observers have referred to the nests of the King Cobra (*Naia bungarus*). The snake on many occasions has been found coiled round her eggs on an accumulation of leaves and vegetable debris. It is not known whether the female gathers up these leaves together herself or whether she makes use of a chance accumulation of them. The latter appears to be the most probable explanation. Ordinarily, the eggs of snakes are laid in rank grass or decaying vegetation, in refuse heaps, under rocks or among the roots of trees or in holes and cavities in the soil; in situations where the heat engendered by the immediate environment helps in the incubation. It is true that with many snakes, the female by coiling her body round the eggs assists in their incubation; her presence must also help to protect the eggs from many enemies. Female cobras have been dug up frequently with their eggs. A common krait has been observed to remain coiled up about her eggs even when the embryos within them were 6 ins. long. A King Cobra was shot over her eggs when the embryos in them were capable of movement. Pythons again, are known to incubate their eggs. The habit is apparently well established among snakes though incubation by the parent is not essential and may and does often cease before the eggs actually hatch out. Once the eggs hatch out the maternal duties of the parent are over. The young spread out in all directions and fend for themselves. But in the innumerable records which are available relative to finding of the female snake with her eggs one striking fact emerges. There are practically no records of the discovery of the male in association with the female at this period. It has been observed that the male of the King Cobra does in some instances at least remain in the vicinity of the female while she is on the nest.

Again in the case of Shaw's Wold Snake (*Lycodon striatus*), Wall records an incident when a female and male were unearthed by some coolies together with 4 eggs. But from the numerous instances in which solitary females have been found with their eggs it must appear that the partnership with the male is usually dissolved immediately before or after the deposition of the eggs. Writing of the Python, Col. Wall says, 'I have numerous records of Pythons found lying with their eggs but with one exception no mention is made of any other snake lying close at hand.' As far as we know at present the association of males with females, though maintained during the period of gestation, is not as a general rule continued after the deposition of the eggs or young. The association ends when the eggs are laid or about to be laid. Such association as exists is brought into being or originates as a response to stimuli which become active during the breeding season and ends when such stimuli cease to operate.

If snakes live individual lives, and we do not usually find them moving about in pairs, except during the breeding season, the sexes must have some means of finding each other when stirred to seek or to maintain such an association. The males must in some way be able to discover the whereabouts of the females or vice versa.

Now in one group of reptiles we believe that this is effected by means of scent glands. Crocodiles carry two pairs of these scent glands which secrete a brownish smeary liquid with the odour of musk. One pair is situated on each side of the throat under the lower jaw and the second pair in the region of the vent. The secretion is most active during the rutting season when the glands are most active; the use of these scented organs which are possessed by both sexes is believed to be hedonic. It is believed that the sexes are able to follow and find each other, thanks to the streak of scented water left behind by each individual. Lizards have no scent glands but among many families we find what we describe as femoral pores. These pores are arranged in rows on the undersurface of the thighs, in front of the anal opening. Each of these pores perforates a scale and leads to a tubular invagination which is lined with epidermal cells. The proliferation of these cells produces a heavy yellowish debris which fills the tube and appears above the surface as a small cone. The use of this secretion is unknown but here again it is believed to be hedonic. Stink glands are again found in the inguinal region of the Mud turtles (*Cinosternidae*) and tortoises of the genus *Clemmys*. Now all snakes carry a pair of roundish glands in the region of the vent. Not only are the glands possessed by both sexes in all snakes but the odour and the appearance of the secretion in these glands seems to differ with the species. In the Common Krait it is a blackish substance of the consistency of soft ointment with a peculiarly disagreeable smell. The contents of the scent glands of the Python has the odour of musk. In the Dhaman, the secretion looks like creamy custard. In the Checkered Water Snake this secretion is bright yellow. It may be that these scent glands serve during the breeding season a similar purpose to that attributed to the scent glands of crocodiles and lizards. That they afford a means by which the sexes are able to trace each other, by leaving behind the individual, an odour which is recognizable to other individuals of the same species. That the odour of the secretion is persistent and not easily effaced, is the common experience of all those who have handled snakes. If the scent glands serve the suggested purpose, they would provide one of the aids by which a cobra or any snake is able to trace another of its species, during the period when snakes are impelled to seek association with one another. It is true that in many species of snakes these glands have been found to be active in all stages of growth—even in hatchlings which are not sexually mature, and as such, it is argued that the glands are not directly connected with the sexual functions of a snake. The scent glands of crocodiles are also present at all stages of growth but they are particularly active during the breeding season when the glands are partly everted. They can also be stirred to activity under the stimulus of fear or excitement. It has been observed that baby crocodiles and alligators turned these glands inside out like the fingers of a glove when seized or held by force. The glands and their noisome secretion become a weapon of defence. Exactly the same procedure is adopted by the tortoise *Clemmys leperosa* which gives out a disagreeable offensive smell something like the concentrated essence of fish. Freshly-caught specimens stink horribly but when they have been accustomed to being handled they cease to make use of these glands. It is again the common experience of all those who have handled snakes that these reptiles discharge the horrible contents of the cloaca and the scent glands when seized, but once accustomed to handling these demonstrations are not indulged in.

To sum up, the social life of snakes is limited as far as we know mainly to the breeding season:—That the association between the sexes may be continued after actual union has taken place and may extend till the deposition of the eggs or young. That it is not usually continued after the eggs or young are produced. That the secretion of the scent glands is discharged under stress of fear or excitement and that it is specific and that by particular activity during the breeding season it may provide a medium by which a snake of a particular species is able to trace the whereabouts of another snake of the same species. In short, there is some foundation for the popular belief that a snake traces its mate.

I have here suggested the possibility of the occurrence but further investigation would be necessary to establish the correctness of the theory. In incidents of this nature it would be necessary to establish the species and sexes of the snakes concerned, to furnish data if possible of the condition of the genital organs and of the scent glands, to note the time of the year in which the incident took place. Observations relative to the season of the year in which snakes are seen in pairs, breeding habits, the period of gestation, the period of incubation, the presence or absence of the male during this period would help to furnish information relative to the relationship between the sexes in snakes of which so little is actually known.

Again from recorded observations we assume that among snakes partnership between the sexes is dissolved after the deposition of the eggs. Yet we know that in the case of two species at least some form of partnership may have been continued after the eggs were deposited. All these problems require further elucidation and their solutions can only be arrived at by further observations in the field.

NEW PLANTS FROM WAZIRISTAN

BY

E. BLATTER, S.J., Ph.D., F.L.S.

Erodium nanum Blatter, sp. nov. [Geraniaceae]; pertinens ad Sectionem Barbatorum et Subsectionem Petraeorum Brumh. affinis est E. trichomanifolio L'Herit., sed distinguitur nullis partibus glandulosis, rhachi inter pinnas integra, pedunculis 2-floris, involucro paucibracteato, bracteis connatis, sepalis 3-nervosis.

Annum, usque 4 cm. altum, acaule, totum excepta corolla incano-hirsutum pilis basi incrassatis. Radix verticalis, 5 cm. longa, ad collum stipulis squamosa. Folia omnia basalia, multa, ambitu oblonga, bipinnatisecta, rhachi integra, usque 4 cm. longa, 1.3 cm. lata; petioli 1-1.4 cm. longi; pinnuli integri vel pinnatisecti, lacinuli lineares vel oblongi, acuti. Stipulae lanceolato-acuminatae, glabrescentes, petiolo basi adnatae. Pedunculi basales, ascendentes, graciles, 2-flori, usque 2 cm. longi, ca. 0.5 mm. diam. Involucrum paucibracteatum; bracteae 4, duo vicini caeteris minores, parte inferiore connatae, late triangulares, acutae, maiores 1.5 mm. longae, 1 mm. latae, membranaceae. Pedicelli 2-3 mm. longi, eglandulosi, filiformes, calyci aequilongi; fructiferi paullum incrassati, 7 mm. longi, retroflexi. Sepala anguste oblonga, usque 4 mm. longa, 1 mm. lata, nervis 3 crassioribus prominenter percursa, albo-marginata, pilis albis speciatim parte inferiore densissime obsita, apice longe aristata, arista 0.5 mm. longa, crystallina, sub fructu demum 5 mm. longa. Corolla carnea, 9 mm. diam.; petala aequalia, immaculata, 3-venosa, calyce paullo longiora, oblonga, apice rotundata. Pistillum hirsutum. Rostrum 25 mm. longum, appresse hirsutum.

Annual, up to 4 cm. high, stemless, the whole, excepting the corolla, incano-hirsute with hairs thickened at the base. Root vertical, 5 cm. long, the neck crowded with stipules. All leaves basal, many, oblong in outline, bipinnatisect, up to 4 cm. long, 1.3 cm. broad; rhachis entire; petioles 1-1.4 cm. long; pinnules entire or pinnatisect; lacinules linear or oblong, acute. Stipules lanceolate-acuminate, glabrescent, at the base adnate to the petiole. Peduncles basal, ascending, slender, 2-flowered, up to 2 cm. long, about 0.5 mm. diam. Involucre few-bracteate; bracts 4, two neighbouring ones smaller than the rest, connate in the lower part, broadly triangular, acute, the larger ones 1.5 mm. long, 1 mm. broad, membranous. Pedicels 2-3 mm. long, eglandular, filiform, as long as the calyx; in fruit slightly thickened, 7 mm. long, bent back. Sepals narrowly oblong, up to 4 mm. long, 1 mm. broad, prominently 3-nerved, white-margined, densely covered with white hairs, especially in the lower part, long aristate at the apex with a crystalline 0.5 mm. long awn, in fruit finally 5 mm. long. Corolla flesh-coloured, 9 mm. diam.; petals equal, not spotted, 3-veined, slightly longer than the calyx, oblong, rotund at the apex. Pistil hirsute. Rostrum 25 mm. long, appressedly hirsute.

Locality: N. Waziristan: W. of Datta Khel Fort, gravel plain (Blatter & Fernandez 613, type).

Flowers and Fruit: 13-3-30.

Erodium adenophorum Blatter, sp. nov. [Geraniaceae]; pertinens ad Sectionem Barbatorum et Subsectionem Gruinorum Willk. et Lange vicina est E. Hoefftiano C. A. Meyer a qua tamen distinguitur stipulis ciliatis, pedunculis 2-3-floris, involucro 2-3-bracteato, bracteis margine ciliatis, sepalis 3-vel 5-nervosis glandulo-hirsutis inaequalibus.

Annuum usque 7 cm. altum. Radix verticalis, tenuis satis longa, simplex, Caules pauci. Folia basalia pauca, persistentia; petioli eorum laminae circ. aequilongi vel ea 1½ plo longiores, pilis mollibus patulis glandulosis hirsuti; lamina ambitu ovata vel oblonga, basi subcordata, usque 2.5 cm. longa, 8-11 mm. lata, supra et infra parcissime hirsuta, margine albo-ciliata; lobi irregulares, pinnatifidi, acutiuscule serrato-dentati; foliorum superiorum lobi similes, petioli generatim breviores. Stipulae late lanceolato-acutae vel spathulatae vel oblongae vel ovatae et apice obtusae, margine ciliatae, membranaceae, albidae, usque 3 mm. longae, et 1 mm. latae. Pedunculi usque 3.5 cm.

longi, indumento puberulo-glanduloso dense obsiti, 2-3-flori. Involucrum 2-3-bracteatum; bracteae late triangulares, acutae, margine ciliatae, liberae, 1-1.5 mm. longae. Pedicelli 5 mm. longi, fructiferi refracti. Sepala oblonga, 3-vel 5-nervosa nervis elevatis, mucronata mucrone 1 mm. longo, dense glanduloso-hirsuta, 5 mm. longa, 2 mm. lata, quoad latitudinem inaequalia. Petala non visa, in nota carnea. Rostrum 3 cm. longum, patule breviter albo-hirsutum, eglandulosum.

Annual, up to 7 cm. high. Root vertical, thin, rather long, simple. Stems few. Basal leaves few, persistent; their petioles about as long as the blade or 1½ times longer, hirsute with soft, patent glandular hairs; blade in outline ovate or oblong, subcordate at the base, up to 2.5 cm. long, 8-11 mm. broad, above and below sparingly hirsute, margin white-ciliate; lobes irregular, pinnatifid, somewhat acutely serrate-dentate; lobes of upper leaves similar, petioles generally shorter. Stipules lanceolate-acute or spathulate or oblong or ovate and obtuse at the apex with the margin ciliate, membranous, whitish, up to 3 mm. long and 1 mm. broad. Peduncles up to 3.5 cm. long, densely puberulous-glandular, 2-3-flowered. Involucre 2-3-bracteate; bracts broadly triangular, acute, with ciliate margins, free, 1-1.5 mm. long. Pedicels 5 mm. long, in fruit bent back. Sepals oblong, prominently 3- or 5-nerved, mucronate with a mucro 1 mm. long, densely glandular-hirsute, 5 mm. long, 2 mm. broad, unequal as to breadth. Petals not seen, pink (from note). Rostrum 3 cm. long, patently and shortly white-hirsute, eglandular.

Locality: N. Waziristan: Khajuri Post, bed of Sna Algad, gravel and sand (Blatter & Fernandez 368, type).

Flowers and Fruit: 26-3-30.

Erodium heterosepalum Blatter, sp. nov. [Geraniaceae]; pertinens ad Sectionem Barbatorum et Subsectionem Malacoideorum Willk. et Lange, refert E. triangulare (Forsk.) Muschler sed ab eo distinguitur stipulis margine ciliatis, pedunculis et pedicellis dense retrohispidis, bracteis 5, liberis, sepalis 3- vel 5-nervosis inaequalibus.

Annuum, caulescencs, usque 11 cm. altum. Radix verticalis vel tortuosa, radiculis tenuibus lateralibus parum armata. Caules pauci, retro-hispidi, ascendentes, parum ramosi. Folia basalia pauca; petioli quam lamina 1-3-pla longiores, pilis retrosis hispidi; lamina ambitu ovato-reniformis vel cordata, retro-hispida, usque 3 cm. longa et 2.5 cm. lata, intense lobata; lobi pinnato-incisi; lacinulae integrae, obtusae; folia superiora brevius petiolata, summa subsessilia et pinnatifida. Stipulae variabiles, late ovatae acutae, membranaceae, pallidae, parce puberulae, margine ciliatae, usque 5 mm. longae et 4 mm. latae. Pedunculi longitudine diversi, inferiores 3.5 cm. longi, superiores 1 cm., generatim 7-flori satis stricti, dense retro-hispidi. Involucrum 5-bracteatum; bracteae liberae, rotundatae, obtusae vel subobtusae, glabrae, margine ciliatae, usque 3 mm. longae et latae, membranaceae, pallidae. Pedicelli usque 5 mm. longi, filiformes, fructiferi non incrassati, dense retro-hispidi, refracti. Sepala oblonga, 3- vel 5-nervosa, mucronata, inaequalia, maiores 4 mm. longa, 1 mm. lata, albo-marginata, dense hirsuta. Petala parva, aequalia, purpurea, immaculata, breviter unguiculata, calyce breviora, oblongo-obovata, apice rotundata. Filamenta calyce breviora. Pistillum argenteo-hirsutum. Rostrum usque 3 cm. longum, pilis brevibus patulis obsitum.

Annual, caulescent, up to 11 cm. high. Root vertical or tortuous, lateral rootlets thin, not many. Stems few, retro-hispid, ascending, little branched. Basal leaves few; petioles 1-3 times as long as the blade, retro-hispid; blade in outline ovate-reniform or -cordate, intensely lobed, up to 3 cm. long and 2.5 cm. broad; lobes pinnato-incised; lacinules entire, obtuse; upper leaves with shorter petioles, the uppermost subsessile and pinnatified. Stipules variable, broadly ovate, acute, membranous, pale, sparingly puberulous, with a ciliate margin, up to 5 mm. long and 4 mm. broad. Peduncles differing in length, the lower ones 3.5 cm. long, the upper ones 1 cm., generally 7-flowered, rather strict, densely retro-hispid. Involucre 5-bracteate; bracts free, rotund, obtuse or subobtuse, glabrous with ciliate margins, up to 3 mm. long and broad, membranous, pale. Pedicels up to 5 mm. long, filiform, in fruit not thickened, densely retro-hispid, bent back. Sepals oblong, 3- or 5-nerved, mucronate, unequal, the larger ones 4 mm. long, 1 mm. broad, white-margined, densely hirsute. Petals small, equal, purple, not spotted,

shortly clawed, shorter than the calyx, oblong-obovate, rotund at the apex. Filaments shorter than the calyx. Pistil silvery-hirsute. Rostrum up to 3 cm. long, with short patent hairs.

Locality: N. Waziristan: E. of Miranshah Fort, right bank of Chasmai River, on sand between rocks, 3,100 ft. (Blatter & Fernandez 201, type).

Flowers and Fruit: 23-3-30.

Trigonella lasia Blatter, sp. nov. [Papilionaceae]; affinis T. pubescenti Baker a qua tamen distinguitur indumento villoso, stipulis ovato-lanceolatis petiolo longioribus, foliolis dentatis (non inciso-dentatis), pedunculis folio multo longioribus 3-5-floris, legumine hirsuto, seminibus 7-9.

Tota planta corolla fructuque exceptis dense villosa. Caules validi, procumbentes, valde ramosi ad 15 cm. longi. Stipulae ovato-lanceolatae, acuminatae, obscure dentatae, coalitae, petiolo longiores, ad 7 mm. longae. Folia 3-foliolata, 1.5 cm. longa. Foliola oblongo-obovata, obtusa vel truncata vel emarginata, apiculata, basi cuneata, dimidia parte superiore denticulata. Petioluli: foliolorum lateralium fere absentes, folioli terminalis 2 mm. longi. Pedunculi 1½-2-plo folio longiores, in fructu multo longiores, 1-5-flori. Flores breviter racemosi capitati, 4.5-5 mm. longi, flavi. Pedicelli 1-2.5 mm. longi. Calyx 3.5 mm. longus, tubus 1.5 mm., segmenta aequilonga, 2 mm. longa, lineari-subulata. Corolla e calyce paullum exserta. Vexillum oblongo-obovatum exunguiculatum. Legumen lineari-oblongum, 1 cm. longum, 3 mm. latum, turgidulum, compressum, rectum, brevissime rostratum, transversaliter approximatim necnon elevatim venosum, hirsutum, apice oblique truncatum; sutura superior validissima, inferior tenuiter nervosa. Semina 7-9, oblonga, brunnea, basi oblique cordata.

The whole plant, corolla and pod excepted, densely villous. Stems stoutish, procumbent, much branching, up to 15 cm. long. Stipules ovate-lanceolate, acuminate, obscurely dentate, united, longer than the petioles, up to 7 mm. long. Leaves 3-foliolate, 1.5 cm. long. Leaflets oblong-obovate, obtuse or truncate or emarginate, apiculate, cuneate at the base, denticulate in the upper half. Petiolules of terminal leaflet 2 mm. long, of lateral almost absent. Peduncles 1½-2 times as long as the leaf, in fruit much longer, 1-5-flowered. Flowers shortly racemose, capitate, 4.5-5 mm. long, yellow. Pedicels 1-2.5 mm. long. Calyx 3.5 mm. long, tube 1.5 mm., segments all of equal length, 2 mm. long, linear-subulate. Corolla slightly exserted. Standard oblong-obovate, without claw. Pod linear-oblong, 1 cm. long, 3 mm. broad, slightly turgid, compressed, straight, very shortly rostrate, transversely and narrowly raised-venose, hirsute, obliquely truncate at the apex, upper suture very strong, lower much thinner. Seeds 7-9, oblong, brown, obliquely cordate at the base.

Locality: S. Waziristan: Razmak, 6,750 ft. (Fernandez 1883, type; 1841, 1853, 2320, cotypes).—E. of Razmak, on a small stony plateau, 6,800 ft. (Blatter & Fernandez 1905).—Bare Top Hill E. of Razmak, 7,000 ft. (Fernandez 3373).

N. Waziristan: Below Razmak Narai, slope of ravine, 7,000 ft. (Blatter & Fernandez 1210).

Flowers and Fruit: 25-4-30; 6-5-27 (Razmak).

Trigonella psilorhynchos Blatter, sp. nov. [Papilionaceae]; pertinens ad Sectionem Eutrigonellae similis est T. callicerati Fisch. a qua tamen distinguitur habitu prostrato, calyce hirsuto, legumine glabro cylindrico-compresso rostro multo breviore, seminibus oblongis basi oblique cordatis.

Pubescens; caules prostrati inferne demum indurati. Folia ad 8 mm. longa; petioli 3 mm. longi pubescentes. Foliola cuneata late obovata apiculata crenato-denticulata, supra glabra infra parce pubescentia, ad 3 mm. longa apice 3.5 mm. lata; nervi utrinque elevati prominentes. Stipulae semisagittatae basi et saepe sursum dentatae. Pedunculi graciles pubescentes folio longiores ad 14 mm. longi aristati 1-5-flori. Flores flavi umbellati; pedicelli ad 4 mm. longi dense appresse hirsuti. Corolla 6 mm. longa; calyx corolla duplo brevior hirsutus; segmenta tubo aequilonga lineari-lanceolata. Legumen (immaturum) deflexum, rectum vel falcatum compressum ca. 1 cm. longum et 1 mm. latum glabrum nervis transverso-obliquis fortibus striatum, duobus nervis suturalibus validis munitum, apice longe subulato-rostratum. Semina 5-8, oblonga, basi oblique cordata.

Pubescent; stems prostrate. Leaves up to 8 mm. long; petioles 3 mm. long, pubescent. Leaflets cuneate, broadly obovate, apiculate, crenate-denticulate, glabrous above, sparingly pubescent below, up to 3 mm. long, 3.5 mm. broad at the apex; nerves raised, prominent on both sides. Stipules semi-saggitate, dentate at the base and often upwards. Peduncles slender, pubescent, longer than the leaves, up to 14 mm. long, awned, 1-5 flowered. Flowers yellow, umbellate, pedicels up to 4 mm. long, densely and appressedly hirsute. Corolla 6 mm. long; calyx half as long as the corolla, hirsute; segments as long as the tube, linear-lanceolate. Unripe pod deflexed, straight or falcate, compressed, about 1 cm. long and 1 mm. broad, glabrous, striate with strong transverse-oblique nerves, both sutural nerves well developed, at the apex a long subulate beak. Seeds 5-8, oblong, at the base obliquely cordate.

Locality: S. Waziristan: W. of Razmak Camp, stony plain, 6,800 ft. (Blatter & Fernandez 1721 type).

Flowers and Fruit: 24-4-30.

Astragalus lasius Blatter, sp. nov. [Papilionaceae]; affinis A. subumbellato Klotzsch, a quo distinguitur omnibus partibus, excepta corolla, villosis, foliolis oblongo vel oblongo-obovatis, stipulis subulatis, corolla calyce duplo longiore, segmentis tubo longioribus, carina alis aequilonga, corolla atro-rubra.

Tota planta, excepta corolla, albo-villosa. Caules multi, erecti vel procumbentes, ad 15 cm. alti, validi. Stipulae parvae, subulatae. Folia brevipetiolata, ad 5.5 cm. longa; foliola distantia, subsessilia, 5-5.5 mm. longa, ad 3 mm. lata, oblonga vel oblongo-obovata, obtusa, generatim 6-9-juga. Pedunculi folio subbreviores ex axillis surgentes. Racemi laxiusculi, 3-13-flori; pedicelli ca. 1 mm. longi. Flores 12 mm. longi, atro-rubri, bracteae subulatae. Calyx 5.5 mm., tubus 2.5 mm., segmenta 3 mm. longa, setacea. Vexillum ellipsoideum, apice retusum, 11 mm. longum; ungues perbreves. Alae anguste lineares apice obtusae. Carina obtusa, basi auriculata, 8 mm. longa, alis aequilonga. Legumen immaturum hispidum, biloculare. Semina 20.

The whole plant with the exception of the corolla white-villous. Stems many, erect or procumbent, up to 15 cm. high, stout. Stipules small, subulate. Leaves short-petioled, up to 5.5 cm. long. Leaflets distant, subsessile, 5-5.5 mm. long, up to 3 mm. broad, oblong or oblong-obovate, obtuse, generally 6-9-jugate. Peduncles slightly shorter than the leaf, arising from its axil. Racemes somewhat lax, 3-13-flowered; pedicels about 1 mm. long. Flowers 12 mm. long, dark red; bracts subulate. Calyx 5.5 cm. long, tube 2.5 mm., segments 3 mm., setaceous. Standard ellipsoid, retuse at apex, 11 mm. long, claw very short. Wings narrowly linear, obtuse at the apex. Keel obtuse, auricled at the base, 8 mm. long, as long as the wings. Unripe pod hispid, bilocular. Seeds 20.

Locality: N. Waziristan: Below Spinwam Fort, bank of Kaitu River in grassland, 2,600 ft. (Blatter & Fernandez 754, type); near Miranshah, bed of Chasmai River, on gravel and sand, 3,100 ft. (Blatter & Fernandez 261, cotype).

Flowers and Fruit: 2-4-30 (Spinwam); 23-3-30 (Miranshah).

Argyrolobium purpurascens Blatter, sp. nov. [Papilionaceae]; affinis A. trigonelloidi Jaub. et Spach, a quo distinguitur colore purpurascenti, stipulis minimis subulatis, foliolis obovato-rotundatis latioribus quam latis, ca. 8 mm. longis et 10 mm. latis, labio calycis inferiore per tertiam partem trifido, legumine longiore et latiore, colore corollae.

Tota planta, excepta corolla, albo-strigosa, purpurascens. Caules permulti, ramosi, flexuosi, procumbentes, ad 20 cm. longi. Stipulae minimae subulatae. Folia 3-foliolata, carnosa, 2 cm. longa. Foliola abovato-rotundata, obtusa vel emarginata, apiculata, basi retusa, subsessilia, latiora quam longa, ca. 8 mm. longa et 10 mm. lata, lateralia valde obliqua. Pedunculi oppositifolii, folio aequilongi vel eo sublongiores, 2-5-flori. Flores breviter racemosi capitati, ad 7 mm. longi. Pedicelli 1-1.5 mm. longi. Calyx bilabiatus, fere ad basin bipartitus, 5.5 mm. longus, tubus 1.5 mm. longus, segmenta labii superioris fere ad divisionem calycis bilabiati partita, lanceolata, integra, labium inferius per quartam partem tridentatum, dentes triangulares, acuti. Corolla paullum exserta. Vexillum extus carneum, intus magis pallidum. Alae flavidae. Carina viridis. Legumina oblonga-linearia, compressa, ad 23 mm,

longa et 3 mm. lata, recta vel arcuata, inter semina leviter constricta, breviter rostrata, appresse strigosa, sutura superior valida. Semina 5-6, magna, glabra, laevia, subglobosa, compressa, brunnea.

The whole plant, excepting the corolla, white-strigose, with a purplish hue. Stems many, branching, flexuose, procumbent, up to 20 cm. long. Stipules, minute, subulate. Leaves 3-foliolate, fleshy, 2 cm. long. Leaflets obovate-rotund, obtuse or emarginate, apiculate, retuse at the base, subsessile, broader than long, about 8 mm. long and 10 mm. broad, lateral ones very oblique. Peduncles opposite the leaves, as long as the leaf or slightly longer, 2-5-flowered. Flowers shortly racemose, capitate, up to 7 mm. long. Pedicels 1-1.5 mm. long, calyx bilabiate, bipartite nearly to the base, 5.5 mm. long, tube 1.5 mm. long, segments of upper lip divided almost to the division of the bilabiate calyx, lanceolate, entire, lower lip tridentate for $\frac{1}{4}$, teeth triangular, acute. Corolla slightly exserted. Standard externally flesh-coloured, inside paler. Wings yellowish. Keel greenish. Pods oblong-linear, compressed, up to 23 mm. long and 3 mm. broad, straight or curved, slightly constricted between the seeds, shortly rostrate, appressedly strigose, upper suture well developed. Seeds 5-6, large, glabrous, smooth, subglobose, compressed, brown.

Locality: N. Waziristan: Near Datta Khel Fort, Daryawasta Algad, 4,600 ft. (Blatter & Fernandez 1642, type).

Flowers and Fruit: 19-4-30.

Argyrolobium mucilagineum Blatter, sp. nov. [Papilionaceae]; affinis A. strigoso Blatter a quo distinguitur pedunculis 3-floris, foliis maioribus utrimque hirsutis, pedicellis multo longioribus, calyce fere ad basin bipartito labii dentibus superioris integris, inferioribus vero late triangularibus, staminibus 9 in tubum coalitis et uno libero, seminibus minutim foveolatis.

Herba perennis, dense et appresse albo-hirsuta, tota planta intus mucilaginea, contrita odorem edens offensivum. Caules elongati erecti et diffusi, ca. 20 cm. longi, flexuosi, graciles, multi-ramosi, appresse hirsuti. Stipulae lanceolato-acuminatae, hirsutissimae, ad 3 mm. longae, integrae. Folia ad 2.5 cm. longa, 3-foliolata, glauca; petiolus 5 mm. longus, hirsutus. Foliola obovato-retusa, apiculata, subsessilia, utrinque dense hirsuta, ad 1 cm. longa, 8 mm. lata, lateralia valde obliqua. Pedunculi oppositifolii, longi vel breves, ad 4 cm. longi, generatim folio aequilongi, 3-flori. Flores carnei, ad 7 mm. longi, breviter racemosi; pedicelli ad 4 mm. longi, hirsuti. Calyx fere at basin bipartitus, bilabiatus, 4.5 mm. longus, labium superius fere ad divisionem calycis bilabiati bipartitum, dentibus lanceolatis integris hirsutis, labium vero inferius oblongum per tertiam partem tridentatum dentibus late triangularibus acutis hirsutis. Corolla calyce longior. Vexillum late obovatum basi ungulatum. Alae auriculatae. Stamina 9 in tubum coalita, unum liberum. Legumen ca. 23 mm. longum, 2 mm. latum, anguste lineare, compressum, inter semina constrictum, rectum, sericeo-strigosum, in rostrum breve brunneum abiens. Semina 11, brunnea, minutim foveolata, globosa, aliquantulum compressa. Indumentum faciei ventralis foliorum multum variat (vide No. 657).

A perennial herb, densely and appressedly white-hirsute, the whole plant inside mucilaginous, when crushed giving off an unpleasant smell. Stems elongated, erect and diffuse, about 20 cm. high, flexuous, slender, much-branched, appressedly hirsute. Stipules lanceolate-acuminate, very hirsute, up to 3 mm. long. Leaves up to 2.5 cm. long, 3-foliolate, glaucous; petiole 5 mm. long, hirsute. Leaflets obovate-retuse, apiculate, subsessile, on both sides densely hirsute, up to 1 cm. long, 8 mm. broad, lateral ones very oblique. Peduncles opposite the leaves, long or short, up to 4 cm. long, generally as long as the leaf, 3-flowered. Flowers flesh-coloured, up to 7 mm. long, shortly recemose; pedicels up to 4 mm. long, hirsute. Calyx nearly to the base bipartite, bilabiate, 4.5 mm. long, upper lip bipartite almost to the division of the bilabiate calyx, teeth lanceolate, entire, hirsute, lower lip oblong, 3-dentate for $\frac{1}{3}$, teeth broadly triangular, acute, hirsute. Corolla longer than the calyx. Standard broadly obovate, clawed at the base. Wings auricled. Stamens 9, fused into a tube, one free. Pod about 23 mm. long, 2 mm. broad, narrowly linear, compressed, constricted between the seeds, straight, silky-strigose, ending in a short brown beak. Seeds 11, brown, minutely pitted globose, slightly compressed.

Locality: N. Waziristan: Below Shewa Post, left bank of Volam River 2,150 ft. (Blatter and Fernandez, 870 type); E. of Spinwam Fort, sandstone nala 2,650 ft. (Blatter and Fernandez 657).

Flowers and Fruit: 5-4-30 (Shewa Post); 1-4-30 (Spinwam).

Astragalus Fernandezianus Blatter, sp. nov. [Papilionaceae]; pertinens ad Sectionem Myobromae Bunge affinis est A. citrino Bunge, sed differt ab eo foliolis magnis paucijugis obovatis, floribus longe peduncalitis, multo maioribus, alis minoribus.

Herba perennis, acaulis vel caulescens; tota, carina alisque exceptis, hirsuto-tomentosa. Folia 2-5 cm. longa, imparipinnata, petiolus 1-3.5 cm. longus. Foliola 1-4-juga late obovata, interdum subemarginata vel obscure apiculata, basi cuneata, carnosa, terminale multo maior, 12 mm. longum et latum, lateralia obliqua subsessilia. Stipulae triangulares acutae. Pedunculi validi, rigidi, ca. 2 cm. longi, uniflori, ex foliorum axillis surgentes. Flores flavi plus quam 3 cm. longi. Calyx subbilabiatus, basi gibbosus, 1.7 cm., tubus 1.2 cm. longus, segmenta dimidium tubum aequantia, lanceolata, duo superiora paullum tribus inferioribus longiora. Vexillum late obovatum vel fere rotundatum, tenuiter obcordatum, extus dense hirsutum, 3.3 cm. longum, in parte latissima 2 cm. diam., unguis 1 cm. longus. Alae late spathulatae, basi brevi auriculo munitae, 2.7 cm. longae, apice 8 mm. latae, ungues 1.7 cm. longi. Carina 2.7 cm. longa, unguis 1.5 cm. Legumen uniloculare, elongatum, cylindricum, subcompressum, stipitatum, 5 cm. longum, 4 mm. latum coriaceum, hirsuto-tomentosum, rostro longo basi hirsuto 1 cm. longo munitum. Semina 8-9, brunnea, parenchymate spongioso circumdata, late reniformia, 2 mm. longa, 4 mm. lata.

A perennial herb, stemless or caulescent; the whole plant with the exception of the wings and keel hirsute-tomentose. Leaves 2-5 cm. long, imparipinnate, petiole 1-3.5 cm. long; leaflets 1-4 jugate, broadly obovate, sometimes subemarginate or obtuse, apiculate, cuneate at the base, fleshy, terminal one much larger, 12 mm. long and broad, the lateral ones oblique, subbsessile. Stipules triangular, acute. Peduncles stout, rigid, about 2 cm. long, 1-flowered, arising from the axils of the leaves. Flowers yellow, more than 3 cm. long. Calyx subbilabiate, gibbous at the base, 1.7 cm. long, tube 1.2 cm., segments half as long as the tube, lanceolate, the 2 upper ones slightly longer than the 3 lower ones. Standard broadly obovate or almost rotundate, slightly obcordate, outside densely hirsute, 3.3 cm. long, 2 cm. broad where broadest, claw 1 cm. long. Wings broadly spathulate, at the base with a small auricle, 2.7 cm. long, at the apex 8 mm. broad, claw 1.7 cm. long. Keel 2.7 cm. long, claw 1.5 cm. Pod unilocular, elongate, cylindric, subcompressed, coriaceous, stipitate, 5 cm. long, 4 mm. broad, hirsute-tomentose, rostrum 1 cm. long, hirsute at the base. Seeds 8-9, brown, embedded in spongy parenchyma, broad-reniform, 2 mm. long, 4 mm. broad.

Vernacular name: Siringai (Waziri).

Locality: S. Waziristan: Razmak, 6,800 ft. (Fernandez 3278, type; 3113, 3174, 3279, cotypes).

N. Waziristan: Alexandra Picket, above Razani, 8,000 ft. (Blatter and Fernandez 1261).

Flowers and Fruit: 5-5-27 (Razmak); 14-4-30 (Alexandra Picket).

Indigofera acanthinocarpa Blatter, sp. nov. [Papilionaceae]; pertinens ad subgenus Acanthonoti Benth. affinis est Indigoferae echinatae Willd. a qua tamen distinguitur petiolis longioribus, stipulis late triangularibus acuminatis, pedunculis 2-4 floris, calycis segmentis multo brevioribus, corolla longiore, leguminis utraque facie 6 seriebus aculeorum hamatorum munita.

Suffrutex erectus. Caules numerosi, ramosi, striati, glabri, parte inferiore rigidi, parte superiore graciles, 30 cm. alti. Folia simplicia, obovato-rotundata, obtusa, interdum apiculata, basi subretusa vel rotundata, 11-15 mm. longa, 11-13 mm. lata, uninervosa, subcarnosa, glauca, infra puberula, supra glabra; petioli ad 4 mm. longi, hispidi, validi. Stipulae late triangulares, acuminatae. Flores racemos axillares formantes; pedunculi graciles, hirsuti, 2-4-flori, dimidium folium attingentes, in fructu folium aequantes; pedicelli 1 mm. longi, hirsuti. Flores 7 mm. longi. Calyx 3.5 mm. longus strigosus, tubus 1.5, segmenta 2 mm., subaequalia, lanceolata. Vexillum obovatorotundum, 5.5 mm. longum, 5 mm. latum, venosum; carina recta, basi auriculata. Stamina diadelphia; antherae uniformes apiculatae. Stylus glaber, stigma capitatum. Legumen stipitatum, breviter oblongum, compressum, stramineum, 5 mm. longum, 4 mm. latum; suturae ambae validissimae glabrae, utraque facies 6 seriebus aculeorum fortium hamatorum munita et itner aculeos hirsuta. Semen unicum, atro-brunneum, oblongum, lateraliter umbonatum.

An erect undershrub. Stems many, branching, striate, glabrous, rigid in the lower part, slender and overhanging in the upper, 30 cm. high. Leaves simple, obovate-rotund, obtuse, sometimes apiculate, retuse at the base or rounded, 11-15 mm. long, 11-13 mm. broad, one-nerved, somewhat fleshy, glaucous, puberulous below, glabrous above; petioles up to 4 mm. long, stout, hispid. Stipules broadly triangular, acuminate. Flowers forming axillary racemes; peduncles slender hirsute, 2-4-flowered, as long as half the leaf, in fruit as long as the leaf; pedicels 1 mm. long, hirsute. Flowers 7 mm. long. Calyx 3.5 mm. long, strigose, tube 1.5, segments 2 mm., subequal, lanceolate. Standard obovate-rotund, 5.5 mm. long, 5 mm. broad, venose; keel straight, spurred at the base on each side. Stamens diadelphous; anthers uniform, apiculate. Style glabrous, stigma capitate. Pod stipitate, shortly oblong, compressed, straw-coloured, 5 mm. long, 4 mm. broad, both sutures very strong, glabrous, both sides provided with 6 rows of stout hooked spines, hirsute between the spines. Seed 1, blackish brown, oblong, laterally umbonate.

Locality: S. Waziristan: Dargai Post, open stony ground (Fernandez 4066, type; 4075, cotype); Tenai Post, stony ground (Fernandez 4030).

Flowers and Fruit: 22-6-27. (Dargai Post).

Euphorbia helioscopioides Blatter, sp. nov. [Euphorbiaceae]; pertinens ad Sectionem Tithymali Boiss. Affinis est E. helioscopiae Linn. a qua distinguitur caulibus basi tantum ramosis foliis minoribus sessilibus, umbellarum radiis longis validis glabris, involucri glandulis transverse oblongis integris (non fimbriatis).

Perennis, erecta vel ascendens glabra. Caules ad 50 cm. alti, crassi, virgati basi tantum ramosi valde foliosi, tandem inferne denudati et indurati fere fruticosi. Folia glabra, sparsa, obovato-cuneata vel late spanthulata, obtusa interdum leviter emarginata, serrulata, sessilia, 2-3 cm. longa, 1-2 cm. lata, membranacea. Umbellarum radii quini validi, ad 6 cm. longi, glabri, trifidi dein bifidi. Folia umbellaria magna sessilia, caeteris similia, 2.5-3.5 cm. longa, ad 1.5 cm. lata, floralia minora, obovata vel subrotunda, umbellaribus similia. Involucrum turbinatum, 2 mm. longum, 1 mm. diam., glandulae transversaliter oblongae integrae, pedicellus 0.5 mm. longus. Capsula glabra, laevis, depresse globosa, 2 mm. longa, 3 mm. lata, profunde trisulca, cocci dorso rotundati. Semina ovoidea basi attenuata, minutim foveolata et insuper elevatim favoso-reticulata, atro-brunnea.

An erect glabrous perennial herb. Stems up to 50 cm. high, stout, virgate, branched only at the base, very leafy, finally denuded below and hardened, almost shrubby. Leaves glabrous, scattered, obovate-cuneate or broadly spatulate, obtuse, sometimes slightly emarginate, serrulate, sessile, 2-3 cm. long, 1-2 cm. broad, membranous. Rays of umbels 5, stout, up to 6 cm. long, glabrous, trifid and then bifid. Involucral leaves large, sessile, similar to the stem-leaves, 2.5-3.5 cm. long, up to 2.3 cm. broad, floral leaves smaller, obovate or almost round, similar to the involucral leaves. Involucre turbinate, 2 mm. long, 1 mm. diam., glands transversely oblong, entire (not fimbriate); pedicel 0.5 mm. long. Capsule glabrous, smooth, depressed-globose, 2 mm. long, 3 mm. diam., deeply sulcate, cocci rounded on the back. Seeds ovoid, attenuate at the base, minutely pitted and besides elevately reticulate, dark brown.

Locality: S. Waziristan: Sararogha, 4,000 ft. (Fernandez 105, type; 105a, cotype).

Flowers and Fruit: 18-5-27.

Euphorbia pauciradiata Blatter, sp. nov. [Euphoriaceae]; pertinens ad Sectionem Esularum affinis est E. Esulae Linn. sed distingui potest umbellarum radiis paucis generatim 3 indivisis, involucri lobis ciliatis, capsula minime punctata vel obscure albo-punctata, caruncula orbiculari-cordata.

Perennis, glabra, glaucescens, 60 cm. alta. Caules fortes, demum indurati, erecti, striati, virgati, ramulosi. Ramuli multi, speciatim in parte superiore,

4-10 cm. longi. Umbellarum radii generatim 3, interdum 1-2 vel 4, validi. indivisi. Folia lineari-lanceolata, sessilia vel subsessilia, uninervia, integra, ad 1.5 cm. longa, ramorum sterilium linearia, multo longiora, ad 4 cm. longa, 1.5 mm. lata, basin versus attenuata, apice subacuta. Folia umbellarum generatim 3, late lanceolata, interdum oblongo-obovata, uninerva, apice acuta, sessilia, ad 15 mm. longa, 3 mm. lata. Folia floralia duo, rhombeo-ovata, saepe irregulariter lobata, apice apiculata, transverse latiora, ca. 7 mm. longa, 9 mm. lata, sessilia, libera. Involucrum campanulatum, lobi lati, breves, truncati, fimbriati, ciliati, glandulae bicornutae, cornua dimidium basis diametrum attingentia. Capsula depresse ovata, profunde 3-sulca, 5 mm. longa, 6 mm. diam., laevis, minime punctata vel obscure albo-punctata. Semina ovato-sphaerica, albido-grisea, 2.5 mm. longa, 2 mm. diam., caruncula orbicularis, versus funiculum cordata, alba, sessilis.

A perennial, glabrous, glaucescent herb, 60 cm. high. Stem somewhat stout, finally hardened, erect, striate, virgate, branching. Branchlets many, especially in the upper part, 4-10 cm. long. Rays of umbel usually 3, sometimes 1-2 or 4, stout, undivided. Leaves linear-lanceolate, sessile or subsessile, 1-nerved, entire, up to 1.5 cm. long, those of the sterile branches linear, much longer, up to 4 cm. long, 1.5 mm. broad, attentuate towards the base, subacute at the apex. Involucral leaves usually 3, broadly lanceolate, sometimes oblong-obovate, 1-nerved, acute at the apex, sessile, up to 15 mm. long, 3 mm. broad. Floral leaves 2, rhomboid-ovate, often irregularly lobed, apiculate at the apex, transversely broader, about 7 mm. long, 9 mm. broad, sessile, free. Involucral campanulate, lobes broad, short, truncate, fimbriate, ciliate; glands 2-horned, horns half the diameter of the base. Capsule depressed ovate, deeply 3-sulcate, 5 mm. long, 6 mm. diam., smooth, not punctate at all or obscurely white-punctate. Seeds ovate-spherical, whitish grey, 2.5 mm. long. 2 mm. diam., caruncle orbicular, cordate towards the funicle, white, sessile.

Locality: N. Waziristan: Miranshah, 3,150 ft. (Fernandez 981, type; 981a, cotype).

Flowers and Fruit: 13-4-27.

Vernacular name: Kharbita (Waziri).

REVIEWS.

LES OISEAUX DE L'INDOCHINE FRANCAISE par. J. Delacour et P. Jabouille. Exposition Coloniale Internationale, Paris, 1931.

We have to thank M. M. Delacour and Jabouille and also the Government of French Indo-China for sending us a copy of this book on the birds of French Indo-China produced in connection with the recent French Colonial Exhibition at Paris. It is stated in the preface that the greater part of the expense of publication has been borne by the Government of Indo-China and we may well believe that share to have been substantial. In these hard times no publisher would have taken the risk of, and few private individuals would have borne the expense of, this fine work.

It consists of 4 volumes, each with roughly 350 pages. In volume I the first 40 pages provide an Introduction and separate chapters on Nomenclature and Classification, History, Geography, Synonymy and Bibliography and these are followed by an account of the species and subspecies of birds which are found in French Indo-China. The account of each species gives its description and measurements, and the distribution, and is written in brief form so that the book will serve as a handy text book to the traveller or colonist in Indo-China.

The genesis of the book was as follows. Some years back M. Delacour decided to undertake the study of Indo-Chinese birds and associated with himself in the work Mr. Jabouille who was, we understand, an official in Indo-China. Five separate expeditions were undertaken to collect specimens between December 1923 and February 1930 and these resulted in the acquisition of 20,000 skins. Amongst this wealth of material 125 species and subspecies were described as new and 205 others were recorded for the first time from Indo-China. The results of each expedition were recorded separately either in the French Reviews or in the *Ibis* and the necessary systematic work and descriptions of new forms were undertaken between each expedition. The present book may be regarded as a summary of all that work and its presentation to the world in more popular and accessible form. It is now to be hoped that naturalists settled for a longer time in the country will feel inspired by this book to study the wealth of bird life in Indo-China and tell us more about it. The Far-east is so rich in bird life and interesting for us that expedition after expedition is sent to the Indo-Malayan countries to collect. The various museums of the world compete for what they can get out of that gigantic bran-pie. But we fear that there is a tendency to forget that the acquisition of skins and the naming of new forms is not the sole end of Ornithology. The resulting papers are little but lists and somewhat sterile discussions on nomenclature and racial systematics; and we long to learn a little more of value—the wealth of reasons behind the wealth of form and colour. It is not all meaningless and the world is slowly growing impatient of an Ornithology that throws away the bird and keeps its skin.

The authors and others whose names are cited in the introductory chapters have nearly completed the initial spade work on the birds of Indo-China. They have told us much of what is there and given a rough outline of the distribution. Now the time is come to study the avifauna in detail and we hope that in the years to come M. Delacour will again put us in his debt by filling in some of the details of the picture he has so ably indicated.

There are 67 coloured plates by Mr. Gronvold which sustain the usual high level of his work and add most materially to the beauty of the book. These help to bring home to the Indian Ornithologist the close connection between the avifauna of India and that of the Malays and Indo-China; and they may serve to remind him that the worker at Indian birds will find some of the answers to his Indian problems in those countries.

H. W.

THE NIDIFICATION OF BIRDS OF THE INDIAN EMPIRE by E. C. Stuart Baker, C.I.E., O.B.E., F.Z.S., etc. Vol. I. *Corvidae-Cinclidae.* (Taylor and Francis. 30/-).

Members of the Bombay Natural History Society, and bird lovers in general, will welcome the latest addition to the bird lore of India from the pen of the greatest living authority on the subject.

As the author himself remarks in the Introduction, it is just over half a century ago that he commenced the formation of his unrivalled collection of eggs of the birds of the Indian Empire which is now in process of being handed over as a gift to the Natural History Museum at South Kensington, and which will in due course be available for study.

During this period, his own collection, as he tells us, 'has been formed by a very careful selection from over 200,000 eggs, seen either *in situ* or brought in, together with bird and nest, by my own trained collectors.' In addition, Mr. Baker's collection has been enchanced by the complete collections of some twenty-five other workers in the field of Indian Ornithology, together with a very large number of individual clutches obtained as opportunity offered.

With this wealth of material at his command, it was only to be expected that such a gifted writer as Mr. Baker would give us something far in advance of anything that has hitherto been published regarding the breeding habits of Indian birds, and the expectation is more than fulfilled.

The work under review follows closely upon the completion of the revised volumes on birds in *the Fauna of British India* series by the same author, and deals with the nidification of nine families of Passerine birds, namely the *Corvidae* (Crow family), *Paridae*, (Titmice), *Paradoxornithidae* (Parrot-bills or Crow-Tits), *Sittidae* (Nuthatches), *Timaliidae* (Babblers and Laughing Thrushes), *Pycnonotidae* (Bulbuls), *Certhiidae* (Tree Creepers), *Troglodytidae* (Wrens), and *Cinclidae* (Dippers).

It thus covers the whole of birds contained in Volume I of the *Fauna*, with the addition of the Dippers, which together with a few races recognised since the first volume of the Fauna was published, number 494, and it is a remarkable tribute to Mr. Stuart Baker's zeal that notes upon the breeding habits, in most cases amounting to fairly complete descriptions, of no less than 408 species and subspecies, are recorded in this volume, or approximately 82 per cent of the species mentioned in the *Fauna*.

This in itself is indicative of the great advance which has been made in our knowledge since the publication of the last standard work on the subject, the second edition of Hume's *Nests and Eggs* in 1889, by Oates. In that work, for the same families that are here dealt with, only in the case of about 48 per cent was anything at all recorded about nidification, and in many cases the information was extremely meagre and frequently insufficiently authenticated.

It is also indicative of the vastly increased interest taken in Ornithology since the first impetus was given by Hume, for even such an indefatigable worker as Mr. Stuart Baker could not have compiled this information but for the assistance of a very large number of field workers, to all of whom a most graceful acknowledgment is made.

As might reasonably be expected, considering that the authorship of both works is identical, the nomenclature in the present volume follows that adopted in the *Fauna*, the only alterations being where the author has seen reason to make a change, as explained, on the rare occasions where this has been necessary, and an additional advantage is the adoption of the same serial numbers in both works.

Thus opening both books at random, No. 144 will be found to be *Ianthocincla rufogularis assamenis*, but whereas in the *Fauna* the trivial name is given as Hartert's Laughing Thrush in the present volume it is called the Assam Rufous-chinned Laughing Thrush.

In his introductory note the author explains his reasons for this. He has entirely dropped the use of surnames of people, however eminent, as trivial names, for the reason that these are usually merely complimentary, and has selected some specific character, e.g. 'rufous-chinned' in the above instance, which separates the bird from its nearest ally, with the addition of a word indicating the geographical distribution.

As a pioneer in India of the trinomial system of scientific nomenclature, some such break from tradition was to be anticipated from the author, and although some of our old friends at first sight may appear strangers under their new names, one has only to become accustomed to the new method to hail it as a considerable advance upon the old.

In dealing with each bird, the author has endeavoured, so far as available information permitted, to give the complete breeding area, nature and elevation of the country where breeding takes place, description of the nest and nesting site, number of eggs in a full clutch, and finally a description of the eggs, with their variations and measurements. Students will agree that he has been extraordinarily successful, but Mr. Stuart Baker himself puts forward a plea for far more information about the nature of the country and elevation where the birds are found breeding, and appeals for assistance from present day field workers.

Mr. Stuart Baker has also seen fit to put in an apologia for the egg collector, and in so doing quite correctly states that we are all collectors first and Zoologists later. He also points out, again quite correctly, that the robbing of a nest simply stimulates the reproductive instinct, and that the birds set to work and lay again.

When working with the late Col. Harington at Maymyo, I well remember him telling me that from statistics which he had recorded he estimated casualties from natural causes as high as 75 per cent. If this is so, the eggs taken by collectors can only form a negligible fraction of the toll taken by the birds' natural enemies, or by storms etc. Personally I had no more compunction in taking the eggs of wild birds than I had in taking those of the domestic hen. Even in this country, where the robbing of certain nests is positively criminal, one hears no complaint of the annual collection, for human consumpion, of Gull's eggs. What harm, then, can the collector do to the teeming millions of bird life in the Indian Jungles?

Having read the book through with extreme care, I can safely say that the information is extraordinarily accurate.

There appears to be a slight error regarding the breeding area of the Jays *G. leucotis leucotis* and *G. leucotis oatesi.* Both are hill birds, and neither are found around Monywa, a town in the dry zone of Burma situated in the plains and not very far from Mandalay.

I have only detected one printing error, *Turdus somervillei* being an obvious misprint for *Turdoides*, and a few misspellings of Burmese place names, e.g. Saquing for Sagaing, due probably to the handwriting of the recorder being illegible.

Such small faults can easily be rectified in the subsequent editions of the work, and for a book of this kind they are amazingly few.

The printing is extremely clear and easy to read, a great advantage to those who will be using it in camp by indifferent artificial light, and not the least attractive feature of the book is found in the eight beautiful plates which are included.

To sum up, Mr. Stuart Baker has once again achieved complete success, and the subsequent volumes will be eagerly awaited.

C. H.

MISCELLANEOUS NOTES.

I.—HOW DOES A TIGER MAKE A 'KILL'?

It is not often that one has the good fortune to witness a tiger in the act of making a 'kill'. An account of an example of this procedure as far as it was allowed to go may therefore be of some interest.

It was the third night that either my brother or myself had sat up in that particular place. The first night it was over a 'kill' that had been made by a tigress—she came not: the second, over a live 'boda' which nothing molested during the hours of darkness: and the third, over the same animal which a wandering tiger happened to encounter at 3.30 a.m.

I was asleep in the machan at the time, wrapped up in a blanket, for it was quite chilly: the night was very dark and still, with clouds hanging about overhead and no moon.

Suddenly a choking bellow from the 'boda' roused me—at once tensely alert and in full possession of all my faculties—to instant action. No time was lost in aligning the rifle and switching on the torch. Its light revealed the muscular form of a large tiger dealing with the half-grown buffalo about 25 yards from the foot of my tree.

The tethered 'boda' was lying on its left side stretched out, its neck pinned to the ground by the tiger's forearms, one paw behind the right ear and the other further down where, in due course, the yoke would go. Its throat was held in a vice-like grip between the tiger's teeth. The tiger's weight was all on his crouching forearm, his hind-legs standing normally with his rump up and tail swishing in the air above it. Had there been some moonlight I would have allowed the tiger to complete this most interesting operation. I was expecting any moment to see him work himself on to the 'boda's' body and, holding it down with his weight, jerk its head round and so snap the neck. As it was, however, he looked up at my light and might have taken fright at any moment. It wasn't worth risking the loss of him, so, taking careful aim at the junction of his neck and shoulder, I fired.

When the reverberations of the rifle shot had ceased and the smoke cleared away I was amazed to see the situation to all intents and purposes reversed. It was really most amusing. The tiger was lying in exactly the same place but had rolled over on his side, and the 'boda', once again on his feet and still tethered, had his head down and was making repeated attacks on the tiger's corpse. Fortunately he could only just reach it with his forehead and was unable to inflict any damage.

When it got light I took a photograph which shows both parties exactly as they were without being moved. In it the 'boda' looks as though nothing had happened to it; its throat, however, was badly bitten through, and already the scratches on its neck were swollen and going septic, so I bumped the poor creature off. Incidentally there were a number of scratches on its buttocks and back showing that the tiger had sprung on it from behind, and probably borne it to the ground before it realized the presence of any danger whatsoever.

[Unfortunately we were not able to reproduce the photo. —Eds.].

Ziarat,
Baluchistan.
October 2, 1932.

R. K. M. BATTYE,
Lieut.,
Hodson's Horse.

II.—PANTHERS OF THE NORTH-WEST FRONTIER.

Some inquiries I recently made regarding the Panthers of the north-west Frontier of India yielded results as interesting to me as I trust they may be to readers of this *Journal.*

At the end of August, in reply to a request for particulars of a skin he reported having seen in Gilgit, Major W. R. F. Trevelyan wrote as follows:—

'I enclose two photographs showing the panther killed in Tangir and in possession of the Political Agent, Major Gillan, compared with one of the two Snow-Leopards' skins which I sent to you in June. I imagine you will be able to decide from these that the skin is of the Indian type rather than the Persian. I must emphasize, however, that it does not occur in this district (Gilgit) and does not seem to be very common in Davel and Tangir. Its limit of distribution is certainly the Indus-Gilgit River watershed and it does not extend to Chilas on the Indus'.

It is not possible, of course, to determine the precise tint of this panther; but, as Major Trevelyan says, it is obviously of the normal Indian type, although it seems to have a better coat and a bolder pattern than any of the few Kashmir skins which I described in my paper upon the Panthers of Asia.

Very little, however, is known about the panthers of that country which is the limit of the range of the Indian race in the north-west. Properly localised skins from anywhere in Kashmir and especially from the area mentioned by Major Trevelyan, would be valuable additions to the collection in the British Museum.

Last year I reported in this *Journal* the occurrence at Sambaya, in Baluchistan, of the typical Persian panther which in colour and length of coat recalls the Snow-Leopard. Through the kind offices of the Bombay Natural History Society the skin upon which this information was based was generously presented to the British Museum by Mr. A. H. K. Sangster. For evidence of the existence of another race of Panthers in Southern Waziristan, I am indebted to Captain D. G. Lowndes who recently sent me a skin, kindly forwarded by the Society, which he procured for the British Museum from the Political Agent of South Waziristan. In his covering letter, Captain Lowndes says the animal was killed somewhere near Wana and is, in his opinion, 'Just an ordinary panther, not a bit like those from the higher hills near here (Razmak) which I am told are grey, almost like a Snow-Leopard.'

The skin is of great interest. It is not like the skin of any ordinary Indian panther that I have seen, but belongs, I have no doubt, to the race, hitherto known only from the Kirthar Range, Sind, which I described on the evidence of a single skin as *Panthera pardus sindica*. Even Blanford, it may be recalled, perceived that this skin represents a variety distinct from the typical Indian panther. It is nearly as bright in hue but has a thick, rather harsh, woolly coat and the pattern is more open, the rosettes being well-spaced, with comparatively thin rims and, on the average, more regular in shape. This type of pattern is emphasised in the skin from South Waziristan; but this skin differs noticeably from the skin from the Kirthar Range in two particulars; the general tint is a dull sandy buff, not nearly so rich and ochreous as in the other, and the coat is quite short and sleek. These differences are no doubt seasonal, the Kirthar Range skin being in winter coat and the southern Waziristan skin in summer coat. The interest of this skin is two-fold. Not only is it the second known skin of this race of panther, but it shows, in addition, the marked seasonal difference in coat and colour in the race and attests the extension of its range considerably further north than was previously suspected.

One more point. It is tolerably certain that the lion entered India from Persia by way of Sind; and being interested to learn if the Sind panther came east of the Kirthar Range, I wrote to Colonel A. H. Mosse for information about the panthers of Gujerat and Kathiawar. In answer he very generously presented some specimens from these districts. One from Bhavnagar, Kathiawar, is a particularly handsome, richly tinted, skin with the centre of the large rosettes unusually dark. Another from Gir is a good deal paler, with normal rosettes and a third from Mahi Kantha, N. Gujerat, is dark tinted like the Bhavnagar specimen, but small in the spots. These panthers belong unmistakably to the normal Indian form.

BRITISH MUSEUM (NATURAL HISTORY), R. I. POCOCK.
LONDON.
November 17, 1932.

III.—JACKAL ATTACKING GOAT.

On the 7th of this month I was sitting up over a live goat which had been tied up near the scanty remains of a natural kill made by a panther two nights before. The panther had not come down to its kill by daylight the previous evening, though I had seen it lying out on the rocks, out of range of my parados, towards sun-down, but I hoped the bleating of the goat would tempt it down earlier on this occasion.

We had not been long in our hiding place when a village 'pi' came to have a chew at the kill. Soon afterwards we noticed a couple of jackal sneaking round but not daring to come too close whilst the 'pi' was in possession. When the sun began to get low the 'pi', evidently thinking the place somewhat unhealthy, cleared out and the jackals sneaked up closer but were sent scurrying off by a pebble lobbed from our hide.

Two or three times we drove them off in this way and then as the light faded I forgot them for a few minutes whilst I scoured the rocks with my glasses, seeking, in vain, for a view of the panther.

A sudden gasp from my shikari, followed by the sound of a scurry below, drew my attention back to the goat with a jerk.

It was standing in an attitude of defence, but, for a moment, I could not see its assailant which, I had no doubt, was the panther. As I stared the attack was launched again—by a jackal, which leapt for the goat's throat only to be shaken off. Not to be deterred, the jackal leapt again and, this time, made good its hold and threw the goat to the ground where it lay kicking and struggling, but plainly unable to free itself from the jackal's strangle-hold.

For a few seconds we were both too stupefied to act, then I realized that if something were not done quickly the goat would be killed and told the shikari to throw a stone. This was done and the jackal let go and fled at once.

It should be noted that it was not dark and the jackal had not taken the goat by surprise nor was the goat hampered by a short tether. The goat was fully twice the size of the jackal and the latter's attack was entirely single-handed.

The goat was not much the worse for its mauling though it had a stiff neck for several days.

B.B. & C.I. Rly., R. M. SIMMONS,
Abu Road. *District Traffic Superintendent.*
June 20, 1932.

IV.—WILD DOGS.

Writing in the *Journal* of the Society for the Preservation of the Fauna of the Empire (New Series, Part XVI), Mr. A. G. W. Milroy, Conservator of Forests, Assam, mentions a possibility of there being two kinds of Wild Dogs in Assam, a larger species hunting in pairs and a smaller type hunting in packs.

I recollect having also previously seen notes on the reported occurrence of a large and small species in the Moyar Valley and at the foot of the northern slopes of the Nilgiris.

I have never seen a Wild Dog with a 'short thick' tail as described by Mr. Milroy, Wild Dogs I have seen both large and small have always carried a definite brush.

I have noticed, however, that Wild Dogs often hunt in pairs, and these appear to be considerably larger than even the leaders of dogs hunting in packs.

The younger dogs in packs seem to carry a more foxy-looking head than the more mature members, later in life developing into a more bull-terrier type.

I think that the instance of large Wild Dogs hunting in pairs is on a parallel with other species of animals usually gregarious by nature not excluding elephant, bison and sambhur, large fine male specimens often being found to wander in pairs.

HONNAMETTI ESTATE, RANDOLPH C. MORRIS, F.Z.S.
ATTIKAN P. O.,
Via MYSORE,
S. INDIA.
September 21, 1932.

V.—'WHITE' BISON.

On October the 11th. I set out in company with Mr. L. Dee of Coimbatore for an area in the South Coimbatore jungles where 'white' bison were said to occur.

We spent the first night at the Chinnar (Travancore) Rest House at the foot of the Munnar Ghat. The following morning we crossed the Pambar river and camped in a forest hut at the Polliya village of Talanji as a 'white' solitary bull was said to have been seen near there. We searched the jungle that evening within a few miles without result, and the following morning camp was shifted again to a large cave on the banks of a ravine east of the Taenar river. This river was in partial flood, and it was no easy matter fording it. It was soon obvious that most of the bison were east of the Taenar. The jungle was perfect for bison stalking, open park-like country. That evening I saw a herd of bison but nothing unusual except that a few of the cows were decidedly lighter in colour than the general run of bison I have seen elsewhere. I also saw a small herd of 5 chital and two sambhur hinds.

Next morning we had better luck. We came on a large herd of 65 bison (possibly two herds grazing together) and among them I saw my first 'white' bison, and its appearance was certainly quite extraordinary, its colour being sandy or light fawn, with horns pink at the base and yellowy white in the upper portions, a good sized bull. I was unfortunately unable to take a photo of the same as the herd got our wind and went off, and remained on the *qui vive* for the rest of the day. On the following day, however, I saw another herd with a 'white' cow of exactly the same type, and in the afternoon a herd with a 'white' cow and a calf. The Polliyars were very emphatic that a large 'white' solitary bull existed in those parts, and was well known by them, and I have no reason to doubt this.

I could only spare five days, and I was therefore unable to cover the country to the extent I would have wished to. I managed, however, to get as far as Manjampatti in the Madura District, and I understand that 'white' bison occur here, also further east in the Kukkal Block, in fact they have been seen in these localities by Messrs. J. L. H. Williams and E. E. Ranicar of the Anamallais, to whom I am indebted for much valuable information on the subject.

I came on a large salt-lick which the bison were obviously very fond of. The banks of the salt-lick had been for the most part licked smooth by their tongues. I took samples of the earth and am forwarding you one of the samples, and shall be obliged if you could have the same analysed in the Haffkine Institute.

I have requested the Collector of Coimbatore to urge Government to take immediate steps to have these 'white' bison protected.

A feature of these jungles is the extraordinary number of Dolmans, some in an excellent state of preservation. One of the upper slabs of rock measured 12½ ft. × 7½ ft. and was 4 ins. thick. As in other places a considerable area of cultivation had been abandoned at Talanji, the result of continual depredations of elephants. We came on two elephants, and there was another herd near by. I should say those jungles hold very few deer, which is not surprising as I saw more than one poachers' hide over water. I saw no signs of bear, and was informed by the Polliyars that they did not occur in those parts, which if true is curious. Along the Taenar there were signs of old irrigation works, including a channel wall. Some of the stones used in its construction are enormous. Square holes had also been worked into the slab rocks bordering the Taenar and Pambar rivers, the first where the irrigation wall originally took off and the latter I think in connection with a bridge; iron supports were probably embedded in these.

I hope to be able to pay another visit to the 'white' bison country some time next year, probably entering from the Pulneys side.

HONNAMETTI ESTATE, RANDOLPH C. MORRIS, F.Z.S.
ATTIKAN P. O.,
Via MYSORE,
S. INDIA.
October 22, 1932.

[The Government of Madras have recently issued orders forbidding the shooting of White Bison in the districts where they occur. Similar orders have been issued by the Travancore Government.—EDS.]

VI.—AGE OF BISON.

I am reliably informed that a bison head has been picked up in Tinnevelly (the skeleton was intact) with 31 corrugations in a depth of 15 inches. It must have been a very old bull and exactly what its age was at the time of its death must be I suppose purely a matter of speculation. On the basis of a year to each corrugation the bison would have been 31 years old at the time of its death, but would a bison live to this age?

I doubt anyhow if it could have been older than a bison that was shot recently in these parts with one horn worn down to a stump, deaf, partly blind and with most of its teeth missing. This bull had nine corrugations, and I put its age down to between 20 and 25 years.

I believe that in the case of domestic cattle one way of telling the age is by giving a year for each ring on the horn, and then adding two. This could not possibly apply to the Tinnevelly bison!

It would be interesting I think to collect opinions as to the average life of a bison.

HONNAMETTI ESTATE, RANDOLPH C. MORRIS, F.Z.S.
ATTIKAN P. O.
Via MYSORE,
S. INDIA.
June 19, 1932.

VII.—ELEPHANTS.—AGE TO WHICH THEY LIVE IN CAPTIVITY.

There are in the possession of the Madras Forest Department 78 elephants of over twenty years of age.

S. No.	Name and sex of elephant	How obtained			Age to nearest year on 1-1-'32	Length of time in captivity
		Born	Purchased	Captured		
1	Lalamiah, M.			Mar. 1891	54	41 yrs.
2	Abudl Rahman, M.			Apr. 1900	47	32
3	Savithri, F.			14-5-1912	45	20
4	Eva, F.		1885	...	56	47
5	Hanuman, M.			19-2-1905	42	27
6	Rolly, M.			18-4-1916	30	16
7	Zarah, F.			14-3-1896	48	36
8	Bkathu, F.			6-4-1900	42	32
9	Phyllis, F.			12-8-1904	35	27
10	Looly, M.			25-7-1907	30	24
11	Akbar I, M.	22-2-1888		...	44	44
12	Etona, M.			3-6-1907	31	24
13	Haffiz, M.			4-3-1917	30	15
14	Empress, F.			21-2-1910	44	22
15	Jayam, F.			23-8-1926	30	5
16	Bhavani, F.			9-4-1913	30	17
17	Murree, M.			20-3-1905	30	17
18	Valmiki, M.			12-5-1914	32	18
19	Little Willy, M.			25-5-1915	25	17
20	Mur Mahal, F.			25-2-1898	42	34
21	Jhellum, F.			27-6-1902	37	29
22	Loo, M.			Apr. 1890	54	32
23	Frank, M.			18-10-1906	43	25

S. No.	Name and sex of elephant	How obtained			Age to nearest year on 1-1-'32	Length of time in captivity
		Born	Purchased	Captured		
24	Logo, M.			19-6-1905	29	26
25	Narayana, M.			13-3-1919	32	13
26	Donald, M.			27-1-1907	35	25
27	Theebaw, M.			Jan. 1886	54	46
28	Kurokki, M.			19-2-1905	35	27
29	Godavery, F.			12-3-1915	47	17
30	Kuttiparu, F.			25-8-1907	30	24
31	Monlabaksh, M.			6-4-1911	31	21
32	Kitty, F.			30-7-1903	33	28
33	Padmini, F.			10-4-1930	29	2
34	Ramzanbi, F.			23-2-1928	22	4
35	Ganga, F.			23-9-1915	21	16
36	Shanker, M.			19-1-1916	26	6
37	Horatius, M.			1-8-1918	28	13
38	Forester, M.			15-3-1906	33	26
39	Kamatchi, F.			10-4-1914	36	18
40	Meenakshi, F.	9-3-1889		...	43	43
41	Libera, F.			5-3-1909	39	23
42	Mallathi, F.			26-5-1926	25	5
43	Emily, F.			22-6-1899	52	32
44	Lalitha, F.			2-3-1931	36	1
45	Kunthi, F.			2-3-1931	31	1
46	Ganapathi, M.			4-4-1931	32	1
47	Thamburatty, F.			6-2-1913	31	19
48	Chickaluxmi, F.			27-5-1927	45	5
49	Mehra, F.			27-2-1929	28	3
50	Girija, F.			5-5-1928	49	4
51	Bakerali, M.			10-5-1911	31	21
52	Diwan, M.			31-5-1926	22	6
53	Elsie, F.			31-5-1907	46	25
54	Chandramathi, F.			22-2-1927	50	5
55	Masthi, M.			28-4-1917	27	15
56	Janaki, F.			11-3-1923	23	9
57	Sirdhar, M.			7-8-1906	30	25
58	Krishna, M.			31-3-1916	31	16
59	Bessie, F.	3-7-1899		...	32	32
60	Kali, F.			11-1-1919	38	13
61	Droupadi, F.			20-1-1925	27	7
62	Ranger, M.			17-3-1906	35	26
63	Narasimhan, M.			11-1-1927	35	5
64	Suguna, F.			9-12-1927	34	4
65	Ceasar, M.			12-2-1910	32	22
66	Peri, F.			11-4-1889	67	42
67	Chamundy, F.	1893		...	39	39
68	Devamaji, F.		14-5-1926	...	31	6
69	Rukmani, F.			22-5-1926	24	6
70	Chambagom, F.			9-4-1918	28	14
71	Maharani, F.			27-5-1926	36	5
72	Isabella, F.			Feb. 1898	52	34
73	Countess, F.			6-6-1910	44	21
74	Mothima, F.		14-5-1926	...	28	6
75	Emperor, M.			6-3-1909	35	23
76	Tino, M.			2-3-1917	32	15
77	Nethravathi, F.			21-2-1905	32	27
78	Sutlej, F.			27-2-1902	41	30

2. Summary.

Division	Over 60 years of age	Over 50 years of age	Over 40 years of age	Over 30 years of age	Over 20 years of age	Total
S. Coimbatore	...	2	7	7	...	16
Nilambur	...	2	3	9	4	18
Nilgiris	...	...	...	2	3	5
Wynaad	...	2	4	13	6	25
N. Mangalore	1	...	...	3	1	5
S. Mangalore	...	1	2	4	2	9
Total	1	7	16	38	16	78

The majority of the elephants being young ones, below thirty years of age, no useful estimate regarding the average period of captivity nor the age to which an elephant lives in captivity can be made. The oldest, 'Peri', age 67, was captured in 1889, when she was 15 years old, and has a record of 42 years' service, whereas 'Eva' age 56, of the South Coimbatore Division, purchased in 1885, when she was 9 years old, has a longer record of 47 years. Similarly 'Theebaw', age 54, of the Nilambur Division, captured in 1886, when he was 8 years old, has a record of 46 years; while 'Akbar' born in 1888, of the South Coimbatore Division, has remained with the Department throughout the past 44 years.

According to the Inspector of Livestock, elephant 'Peri', mentioned above, is the oldest that has ever been in the Department. Elephants are reported to have lived for over ninety years in the Mysore Palace. This is attributed to the fact that they are maintained solely for ceremonial purposes. Mr. F. X. Mascarenhas, retired Inspector of Livestock, states, however, that an elephant named Noor Jehan lived to an age of ninety years in the Wynaad Division, and that another named Parvathi was given to the Madras Zoo when she was ninety years old. He mentions also that he had to deal with an elephant named Dodda Laximi and that she was then nearing 120 years. But there is unfortunately no definite record.

There recently appeared, but the source is forgotten, some fabulous story of elephants in Ceylon passing from the Portuguese to the Dutch and so to the British—some very great age was mentioned.

MADRAS,
September 30, 1932.

R. D. RICHMOND, C.I.E., I.F.S.,
Chief Conservator of Forests,
Madras.

VIII.—ELEPHANTS EATING EARTH.

It is curious how elephants seem to go in for eating earth more in some localities than others.

Recently while on a visit to the Cardamom Hills in Travancore I was struck by the fact that throughout the jungles one came across numerous marks of elephant tusks in banks (mostly red clay) which are rarely to be seen on the Billigirirangans (North Coimbatore).

I sent down 2 samples of earth from the Cardamom Hills to Lt.-Col. C. Newcomb, I.M.S., the Chemical Examiner to the Government of Madras, for analysis, and he writes as follows:—

'The results so far are:—

	Red	*Black*
Loss on ignition	12·5	7·7
Alumina	21·4	7·5
Iron as Fe_2O_3	14·1	4·5
Silica	9·3	6·5
Sand and other silicous matter ...	43·1	74·5
Total ...	100·4	100·7

As soon as I can find time I want to do some tests to find out how much acid they will neutralise. Rough tests have shown that it is only a little in any case, and I want to do a more delicate determination myself'.

I believe the general idea is that elephants eat earth to remove 'bots', but I am also informed by the Director of Veterinary Services, Madras, that elephants often suffer from a condition known as 'pica', a depraved appetite probably due to over-acidity, and a desire for an alkaline substance to correct this.

HONNAMETTI ESTATE,
ATTIKAN P. O.,
Via MYSORE,
S. INDIA.
August 23, 1932.

RANDOLPH C. MORRIS, F.Z.S.

IX.—HABITS OF THE MUNTJAC (*M. MALABARICUS*).

I have frequently noticed in the jungle small scraped patches, somewhat similar to a panther's scratchings, which the local Sholagas ascribed to the Jungle Sheep (Muntjac or Barking Deer), but it was only recently that for the first time I saw a Muntjac buck actually doing this, pawing the ground with its forefeet, somewhat similar to the pawing of a horse. With lowered head the Muntjac seemed to paw the ground with long sweeps, using both forefeet alternately. It left a scraped patch of about 1 ft. broad by 2 ft. long.

HONNAMETTI ESTATE,
ATTIKAN P. O.
Via MYSORE,
S. INDIA.
March 10, 1932.

RANDOLPH C. MORRIS, F.Z.S.

X.—THE MIGRATION OF THE PARADISE FLYCATCHER, (*TCHITREA PARADISI*).

In his very interesting note on this subject in a recent number of the *Journal* Mr. Briggs has entered a plea that an effort should be made by the members of the Society to elucidate the migrations of this well-known and conspicuous species, and that they should all contribute any observations that they have made on the subject. In response to this appeal I venture to write the following note.

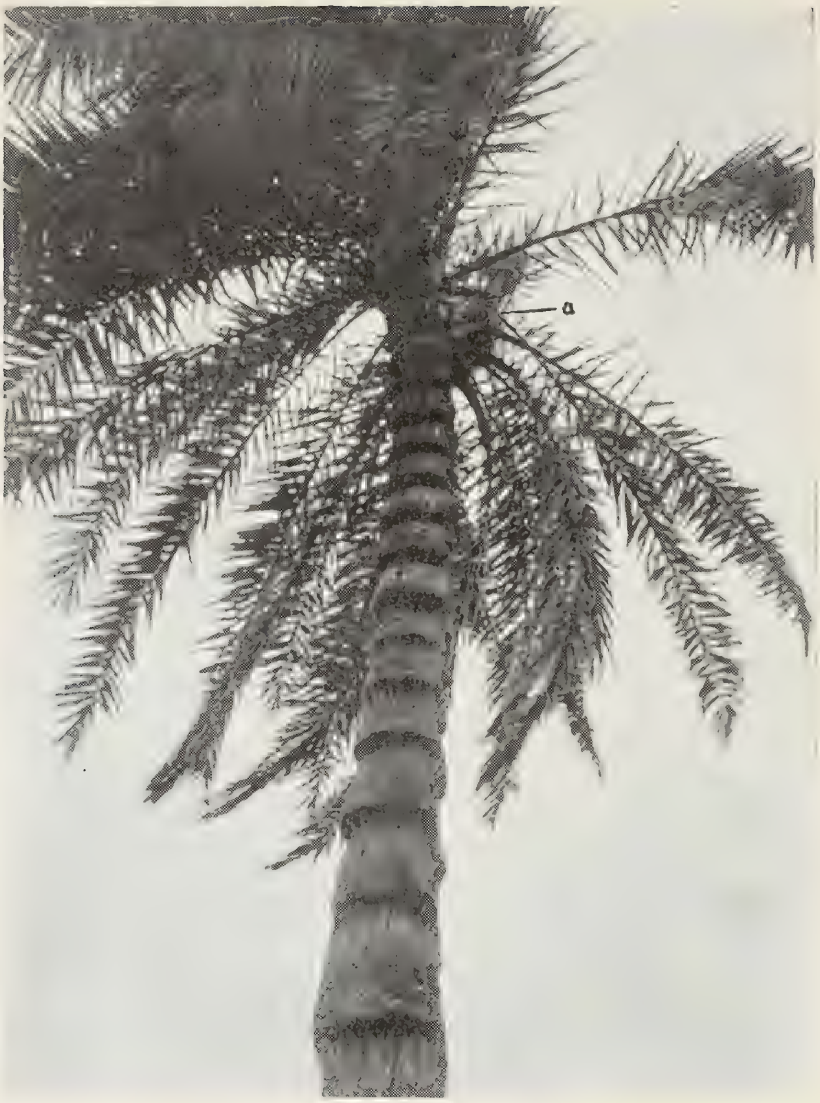
It is in an enquiry of this nature that we reap one of the chief benefits of the study of subspecies because if we are able to divide a species correctly into recognisable subspecies we are then able to follow its migrations so much more clearly. The breeding race of each area can be recognised and traced where it appears on passage and in its winter quarters. A sweeping and generalized account of the movements of the species can be replaced by one of far more detail.

In the course of the Eastern Ghats Survey, published elsewhere in this *Journal*, I have explained that my version of the Indian races of the Paradise Flycatcher differs considerably from that given by Mr. Stuart Baker in the *Fauna*. That paper may be consulted for details of how these races are to be recognised. Here it will suffice to say that in India and Assam I recognise three races *paradisi*, *leucogaster* and *nicobarica*, suspecting also the possibility of a fourth resident race in Ceylon. *Paradisi* is the Peninsula form, *leucogaster* the form of the north-west, and *nicobarica* the bird of the north-east. For the purposes of this enquiry I have collated practically the whole of Indian ornithological literature and examined a large number of privately-owned specimens in addition to the material in the British Museum. Unfortunately many of the most interesting records cannot be identified as referring to any particular race, as to obtain any value from such an enquiry it is necessary to consider the movements of each race separately. Without inflicting a mass of detail on the patience of our members—detail which I retain and can produce in corroboration of all my statements—I may now set forth the conclusions which I have so far reached as to the movements of each of the three races:—

TCHITREA PARADISI LEUCOGASTER.

Apart from its extra-limital distribution, this race breeds along the Himalayas from Chitral to the Nepal valley at moderate and low elevations and also down the N. W. Frontier as far as Quetta. A few also breed in the neighbouring plains, as at Lahore and Delhi. The breeding season is here very definitely defined in May and June, odd nests only being found at the end of April or in July.

In its breeding range this race is only a summer visitor from the end of March to the middle of October. At present I have only evidence of its migrations in two directions, one directly southwards to south-western India; the other almost as directly east-



Date tree with the nest *in situ* of *Lanius nigriceps* Frank.
(a *indicates nest.*)

Close up of the nest *in situ.*

wards. But it must be remembered that we have very little information from central and eastern India and the movement may be really much more of a general fan-shaped one.

Of the southerly migration there is plenty of evidence. The bird is a very noticeable passage migrant both in spring and autumn over a great part of the Punjab, some of these migrants passing in addition over the Indian breeding range as above defined to the extra-limital breeding areas. This migration misses Lower Sindh (where the bird is a mere straggler) and evidently passes down the western ghats. I have examined specimens from Matheran, Mahableshwar, Belgaum, Wynaad, Nilgiris and Bangalore.

Of the easterly movement there is less evidence but Mr. Briggs himself tells us that there is a passage through Ghazipur and that may well be of this form of which I have seen specimens from N. Bihar and also from the Upper Chindwin in Burma (early May).

TCHITREA PARADISI NICOBARICA.

This form breeds along the Buxa and Bhutan Duars and in Upper Assam. It is evidently a summer visitor arriving about March and probably departing about September as Oates (S.F., x. 203) remarks on the large numbers which sweep through Pegu then on a migration. In winter it reaches Tenasserim and also in small numbers the Andamans and Nicobars.

TCHITREA PARADISI PARADISI.

This is evidently the breeding bird of a great part of Peninsula India but from lack of specimens and records I have been unable to trace its breeding range and migrations with any degree of certainty. It is certainly a local migrant but accurate observations referring with certainty to this race and no other are too few for me to suggest the direction of its movements, except that it probably visits Ceylon.

BATTLE ABBEY. H. WHISTLER.
September, 1932.

XI.—FURTHER NOTES ON THE NESTING OF *LANIUS NIGRICEPS* FRANK. WITH OBSERVATIONS ON JUVENILE PLUMAGE.

(*With one plate*).

A dry morning out of a spell of wet days and gusty weather in the wake of regular monsoon afforded me an opportunity of arranging on June 26, 1932 a trip to Basirhat—the same area where last year on July 12, 1931, I found three nestlings—to search for the nests of *Lanius nigriceps* Frank. The present undertaking was very opportune not only because the *char* lands were still uninundated and accessible but also because, as a result of reconnoitring the particular locality about a fortnight ago (May 29, 1932) half a dozen Shrikes—in perfect plumage and song—had been noticed to affect the Date trees (*Phœnix sylvestris*) standing on the *char* lands. Incidentally I might here refer to what had then struck me as a change in the behaviour of those Shrikes, viz., a touch of sensitiveness in their otherwise bold outlook, leading them to give a wide berth to man's presence and scurry away from his gaze. To cite one such instance, when a bird with an insect in its beak had flown up to a Date tree, its pause without any attempt to devour the insect then and there could but have suggested to me the probability of its nest near by, when lo! it had suddenly caught sight of me and forthwith undergone a change of behaviour which took me by surprise and left me bewildering, while the bird had presumably by way of camouflage gulped down the insect in a trice and hurried away to far off thickets, leaving no clue as to its probable nest or young.

Good luck as was expected by me attended my search on June 26, 1932, for not only two fledgelings came to my notice as they were being fed by their parents but also a nest with four eggs was discovered in a Date tree. I revisited the nest on 2nd. July next and found four naked young newly hatched, blind and entirely bare of down—flesh-coloured throughout, with the edges of mandibles yellow. On scrutiny the nest was found to measure as follows:

Inside diameter—88 mm.; Inside depth—81 mm.

Base or outer bottom—142 mm.: this part resting in the axil of the leaf.

Placed about 15 ft. high and beyond being pressed into its position in the axil of the leaf of the Date tree this nest had no other attachment, and I could easily manage to pull it out from and slip it back to its former position. For its external composition it had mainly scraps of roots of grasses like *Imperata arundinacea* and *Saccharum spontaneum*, and fine twigs or branches of thorny shrubs like *Flacourtia ramontchi*, intermingled with downy tops of the above grasses or branchlets of grass panicles—these being only noticeable in the outer base or bottom of the nest and the part resting against the trunk of the tree. The interior of the nest was made up of finer fibres, grass, and bits of midribs of Date leaves.

Apparently this nest of *Lanius nigriceps* Frank. in a Date tree is singular as no mention is found of such trees in connection with the nesting of this species.

It will thus appear from this and my previous record that so far as the district of 24-Parganas is concerned *Lanius nigriceps* Frank. can be taken as a resident bird, though its number is not very large.

The two juvenile Shrikes observed out of nest on June 26, 1932, could be easily captured. Their calls uttered from two different situations some little distance apart, albeit commanding each other's view—one high up on a creeper entwining hedges and the other perched on a dwarf Date tree—were too persistent to be ignored. I had thus another opportunity of examining juvenile plumage which I note below:

Fledgeling out of nest. Younger of the two. 26-6-32.

Chin and throat white; breast and lower parts washed with pale fulvous-chestnut; feathers of forehead nearer nostrils blackish or dark brown, remainder of forehead pale fulvous, crown darker or browner due to dark bases of fulvous-chestnut feathers; nape and upper back lighter fulvous-chestnut; lores and ear-coverts dark or blackish brown—this colour appearing in one line from the edge of forehead near nostrils. Lower back chestnut-fulvous, slightly deeper in tone and with fine barrings of dark brown. Wing dark brown tipped and edged with fulvous-chestnut, with a patch of white along base; wing-coverts dark brown with chestnut edges and tips. Axillaries and under wing-coverts white. Rump and upper tail-coverts fulvous-chestnut; tail dark brown or blackish, tipped and edged with fulvous-chestnut, the two outer feathers light chestnut; flanks pale chestnut with fine barrings of dark or blackish brown.

Legs and feet dark slaty, claws darker; under-side of toes fleshy. Iris light brown. Gape yellow; upper mandible dark or blackish brown with yellow edges, the tip paler or whitish; lower mandible washed with dusky yellow.

Fledgeling out of nest. Older young. 26-6-32.

Colouration same as above. Upper back fulvous-chestnut with considerable barrings of dark brown, lower back with less barrings; flanks with fine barrings of dark brown extending to the sides of breast.

CALCUTTA.
September 7, 1932.

SATYA CHURN LAW, M.A., Ph.D.,
F.Z.S., M.B.O.U., *Hony. Correspondent,*
Zoological Survey of India.

XII.—THE STATUS OF *GEOCICHLA CITRINA CITRINA* LATH. (in the district of 24-Parganas, with a note on nestling colouration).

Instances of the nesting of *Geocichla c. citrina* Lath. in the District of 24-Parganas are not rare. Last year in the month of June I came across two such instances and my observations thereon were published in a short note in the *Ibis* for October, 1931. This year four other cases have come to my notice very lately, the particulars of which are noted below:

End of June, 1932.—Nest with two young found in a mango tree in Jagulia.

July 2, 1932.—Nest and one young obtained near Dum-Dum.

August 6, 1932.—One juvenile, able to fly, captured in an orchard, off Dum-Dum.

August 20, 1932.—Two young grown up and capable of short flight obtained in Rajarhat.

It will thus appear that the individuals thus found breeding and rearing young may safely be reckoned as resident birds of this district.

Judging from the generic traits, this Thrush does not appear to be migratory in the true sense of the word. Yet considerable movements in the wake of migration in winter lead a goodly number of these birds to visit the plains districts throughout India. No doubt this explains why they become so common in winter in Bengal. When the time for summer migration arrives, they retire to breed, evidently as stated in Mr. Stuart Baker's avifauna, in their range 'between 1,000 or 2,000 and 5,000 ft., occasionally a little higher than this'. Yet even at this period some individuals, as will appear from my record, cling to their plains habitat, scattering and betaking themselves to some congenial nesting spots. The latter no doubt have acquired the status of resident birds, their numbers being swelled every year by the progeny that are raised locally and by other individuals which are not loth to evince a non-migratory tendency.

The nestlings and partially fledged young that I happened to discover were no small inducements to my avicultural greed, and of those I secured for enriching my aviary I was lucky enough to hand-rear a few. Their juvenile colouration affords an interesting study, and I append below gleanings of my observations thereon.

Transition stage from nestling to juvenile.—Feathers appearing on head and neck light orange with dark brown edges and pale orange yellow centres, some yellow showing in the shaft; ear-coverts orange brown, feathers with black tips; chin and throat buff with some black in cheek. Breast dirty brown mottled with black and yellow; lower breast and upper abdomen light orange; lower abdomen bare; flanks with few dirty brown feathers undeveloped. Back dirty brown with light orange centre and along the shaft. Tail feathers undeveloped, showing light orange. Quill-feathers undeveloped; primaries and secondaries blackish with a conspicuous splashing of yellow; median and lesser coverts with more yellow, the tips and shafts orange brown; under wing-coverts and axillaries bare. Down wherever found scanty, yellow.

Mouth inside deep yellow, external flanges yellow. Legs, feet and claws flesh coloured; iris bluish brown.

Measurements.—Gape, 21 mm.; tarsus, 32 mm.

Juvenile characters as examined 22 days after *transition* characters were noted.

Crown and forehead dull umber; nape and hind neck orange brown with darker edges and pale centres; sides of neck brighter orange with a black patch below the eye; ear-coverts orange tipped with black; a bare patch behind the eye and above the ear-coverts; lores light orange; cheeks barred with black; chin and centre of throat rather buff in tone, the feathers with dark brown tips; sides of throat and cheeks with larger black brown tips. Breast and abdomen pale orange white, the feathers of the former with black brown tips; flanks sullied. Back and upper plumage dull bluish suffused with a wash of orange. Median and lesser wing-coverts broadly tipped with buff, some feathers of the greater coverts have short rufous tips extending up the shafts.

Bill dull flesh-coloured; the upper mandible blackish horny towards base with some yellow on the tip and along the commissures, legs and feet fleshy pink; iris light hazel. Mouth inside pink, with yellow on the sides; external flanges yellowish white.

CALCUTTA.
August 23, 1932.

SATYA CHURN LAW,
M.A., Ph.D.

XIII.—EXTENDED DISTRIBUTION OF THE WYNAAD LAUGHING THRUSH (*GARRULAX DELESSERTI*, JERDON) TO NORTH KANARA.

While going through the Society's bird collection I was rather surprised to find a single specimen of *Garrulax delesserti* bearing the following data (original label mislaid).

Locality.—North Kanara.

Date.—November 1899. Sex ♂.

Collected by Messrs. T. R. Bell and Harvey.

In the *Fauna of British India*, vol. i, p. 149, the distribution is given as the 'South Indian hills from the Wynaad to the South of Travancore'.

Being in doubt as to the correctness of the label I wrote to Mr. T. R. Bell and received the following interesting letter.

'The specimen was shot at Jalavli village in the Supa Mahal (Haliyal Taluka) of the North Kanara District by H. L. Harvey who was Judge at the time—about the year 1899 at Christmastide. The bird is not rare where it occurs in the North Kanara District but inhabits the crest of the Ghats from North to South (Goa to South Kanara of Madras Presidency). I have seen it in most parts where conditions are suitable: dense Karvi (*Strobilanthus* of various species) growth in very damp places, generally not far removed from evergreen jungles. I noticed it at Kadra, 18 miles from Karwar (coast) and hardly 1,000 ft. above sea-level. Also at Bhatkal close to the Madras boundary and there it was at a height of not more than a few hundred feet and certainly not more than 8 miles from the seashore. It invariably nests in or on karvi stems and nearly always in the monsoon months—July to September in anything from 250 to 350 ins. rainfall.'

E. H. Aitken (EHA) also took eggs at Castle Rock many years ago. Personally I have found many nests but never with eggs. The birds 'quest' through thickets, always hopping along the ground in flocks of up to a dozen or so in search of insects, also no doubt other things; very much like the Seven Sisters, their voices are, however, shrill, a kind of whistling shrillness, very similar to those of the Grey-headed Babbler and *Argya subrufa*.

Mr. J. Davidson, I.C.S., in a paper read before the Society in 1898 (vol. xi, p. 652) said 'it was a rare bird in Kanara. I have only found it in the extreme north-west portion of the district along the Goa frontier, from Castle Rock to Anshi, where it goes about in large flocks. While beating for tiger at Anshi, I obtained a nest in the latter portion of May. It was in a low bush in thick jungle, and was an ordinary small babbler's nest, composed of rough creepers and roots, with a couple of skeleton leaves in the formation. It contained a partially incubated egg; this was pure white and glossy and a very broad oval'.

BOMBAY NATURAL HISTORY SOCIETY, V. S. LaPERSONNE,
BOMBAY. *Assistant Curator.*
October 20, 1932.

XIV.—THE OCCURRENCE OF THE COMMON RUBY-THROAT (*CALLIOPE CALLIOPE PALLAS*) IN THE GODAVERY DELTA.

In the report of the Eastern Ghat Scientific Survey (Birds vol, xxxvi, p. 72.), Mr Whistler gives Vizagapatam as the southern limit of the Ruby-Throat from a specimen collected by me from that district.

I find, however, that from my notes a specimen of *Calliope calliope* ♂ was shot on an island in the Godavery Delta in the month of December 1929.

This as far as we know at present is the southern limit to the Ruby-Throat's migration into the peninsula.

BOMBAY NATURAL HISTORY SOCIETY, V. S. LaPERSONNE,
BOMBAY. *Assistant Curator.*
October 28, 1932.

XV.—NESTING OF THE WHITE-EYE (*ZOSTEROPS PALPEBROSA SEMM.*).

On the 16th. July this year, I observed two White-Eyes (*Zosterops palpebrosa*) very busy prospecting, and noticed that they were particularly interested in a pot of ferns hanging from one of the weather boards of my verandah, and was therefore not surprised to find building operations in progress during the course of the next day or so. By the 20th., the nest, a perfect cup, slung between two fronds of the fern, was complete, and on the 21st. the first egg was laid.

The hen did not sit close on that day or the next, and easily took fright if any one happened to pass by, which was often the case, as she had chosen for her nest a position opposite that portion of the verandah which was used as a sitting-out place. To give her a greater sense of security, a lined 'chick' was kept dropped, so as to hide from her view people passing up and down the verandah.

On the 23rd. the second egg was laid—both eggs being greenish-blue and without gloss. This completed the clutch. The parent birds sat very close from this date, not moving even when the gardener attended to the pots in the immediate vicinity.

Both eggs hatched on the 2nd. August. It was very interesting to note the manner in which the parent birds took turns to forage for food and keep the nestlings warm. A bird would return to the nest with either a caterpillar, or what appeared to be a tender leaf, and would relieve the other that was keeping the youngsters warm. This one would then go off in search of food, while the nestlings were fed and kept warm pending its return, when the parent birds again changed places. At no time, for the first few days after hatching, were the young birds left exposed, the parent birds changing places in the nest in regular rotation, as the other brought along the food.

I made several attempts to take a photograph of the sitting bird, but the weather was very dull, and the wind precluded any hope of a time exposure being successful. The results were unfortunately useless for purposes of publication. I enclose a couple of snapshots showing the nest, taken after the brood had left it.

The young birds left the nest on the morning of the 12th. August, and took up their position in a sandalwood tree about ten or twelve yards away, where they remained all that day, moving further afield on the 13th.

There had been heavy and continuous rain during the period of incubation, but the site for the nest was so cleverly selected that the nest remained dry, being under the shelter of the weather board, and being in the lee of the flower-pot, was protected from the wind.

The parent birds seemed to have no particular difficulty in procuring the necessary food, which seemed chiefly to be a species of small green caterpillar. Small portions of what appeared to be tender leaves or buds were also occasionally noticed.

Whistler in his book *Popular Handbook of Indian Birds* states that this species is purely arboreal and never descends to the ground. I am sorry to disagree with the statement of this authority on birds, but I saw this couple, on more than one occasion, fly down to the gravel path. I was not quick enough to spot what they were after, possibly a small fly or grub.

I am sending you this account in case you think it of sufficient interest to merit publication.

22 Queen's Gardens, Poona. E. E. DOYLE,
August 24, 1932. Lt.-Col., I.M.S.

XVI.—NOTE ON THE INDO-BURMESE PIED HORNBILL (*HYDROCISSA MALABARICUS LEUCOGASTRA*).

(*With a plate*).

On the 8th. of August 1930 I was sent by a friend a young Indo-Burmese Pied Hornbill; and to my astonishment there in the basket was also a fully grown parent bird, presumably the mother. I naturally made enquiries about how the parent bird was caught with the youngster, and the reply from the Mikirs was that they had climbed the tree at night and placed a net over the hole, so that the following morning they could effect the capture of the birds.

Here arises a very interesting point. How did the mother bird come to be in or near the nest with an almost fully grown young bird? The young bird was just able to fly, and was not quite fully fledged (see photographs, taken 4 days after the birds' arrival). Had the wall of the nest been finally broken down and was the mother bird sleeping inside with the young? Or would it be a case of 'a hole within a hole' of a tree, a large cavity with plenty of room for the parent bird or birds to roost at nights just outside the actual wall of the nest? Unfortunately, I was unable to get any further information from the Mirkirs. Perhaps some member of the Society may be able to clear up this point. The parent bird was in a very clean, healthy condition, and showed no signs of having just moulted or of having just been in confinement during incubation.

A further interesting thing about these two birds was the devotion of the mother to her baby. When they arrived I placed them both in a very large cage, but the adult bird was very timid, and refused to eat any food. Two days later she escaped. And yet for three weeks she remained in the neighbourhood, daily returning to the cage with food for her young one. To facilitate this the cage was put in the compound, about 10 yards from the verandah; and it was a most amusing and gratifying sight to watch the big bird cautiously returning to feed the youngster—usually with insect food. Unfortunately this young bird was killed by a cat or some other animal on October 11th. of the same year; though others I have had have stayed with me in a state of freedom for six months before they have flown away.

HAUTLEY TEA ESTATE, E. P. GEE.
ASSAM.
October 2, 1932.

[According to the writer of the above note the parent bird was captured with the young by placing a net over the entrance hole of the nest during the night. We do not know anything about the condition of the wall which closes the nest of the hornbill and imprisons the mother bird and her young for some period after they have been hatched. If the wall was intact there should have been no occasion for the net, as the bird could have been taken by breaking down the nest wall and this could not have been done unless the net was removed. Under the circumstances it would seem that the nest wall had been broken down by the parent bird as she had completed her brooding and was no longer a continuous tenant of the nest, and that she may have used the nest as a roosting place at night. This may explain her presence in the nest with her more or less fully fledged young. In a note on 2 Young Great Indian Hornbills (*D. bicornis*) by the Curator of the Society (Jour. B.N.H.S., vol. xxviii, p. 550) reference is

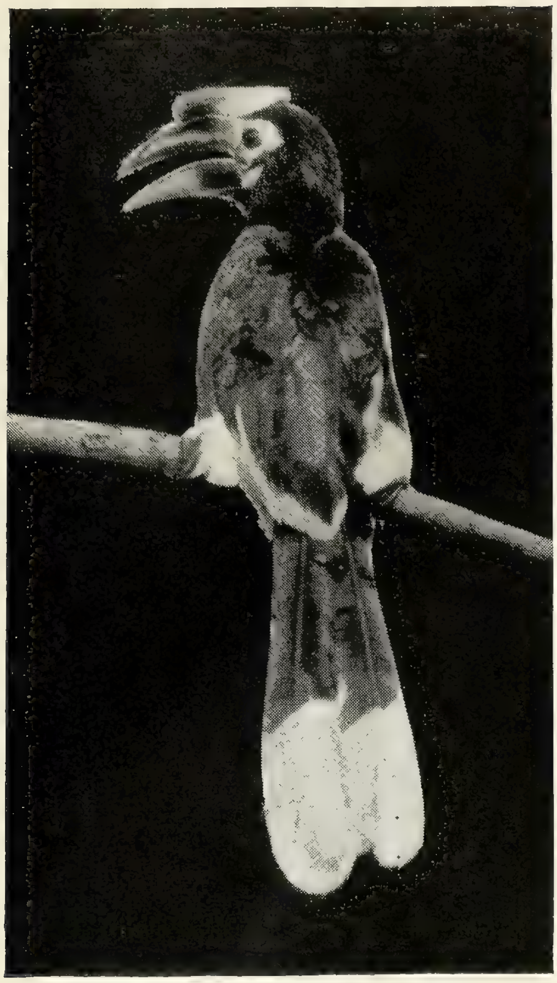


Fig. 1.—Adult ♀ bird.

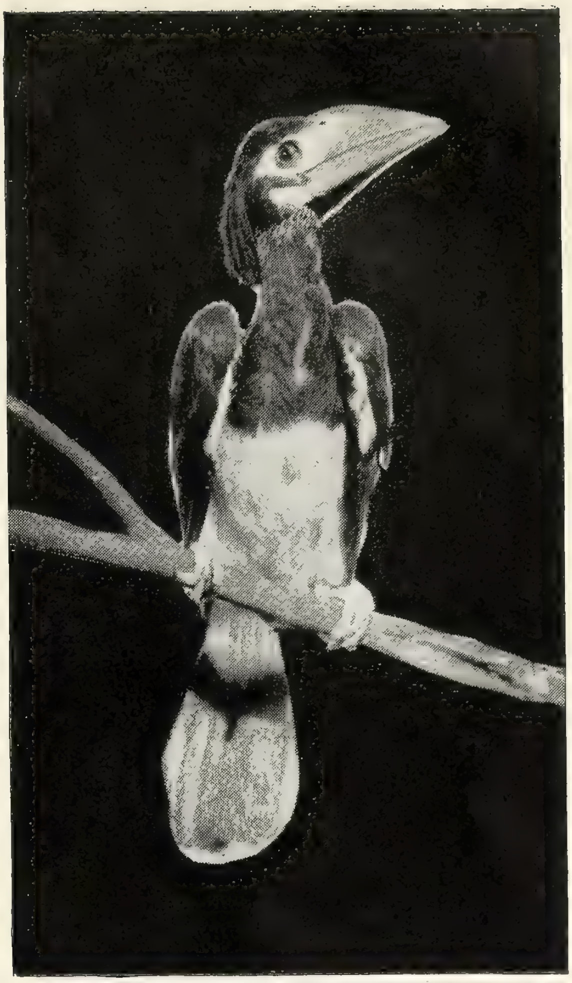
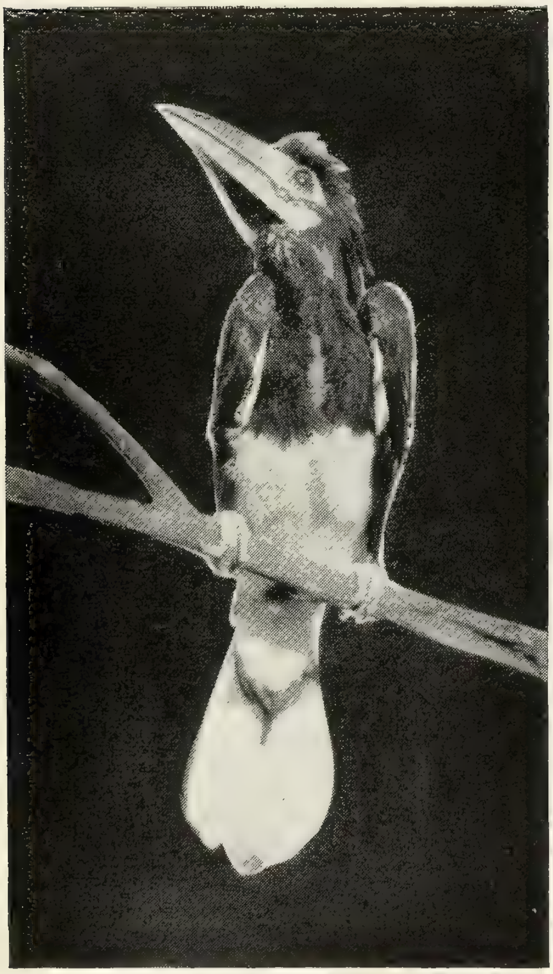


Fig. 2.—Young bird photographed on 12-8-30.



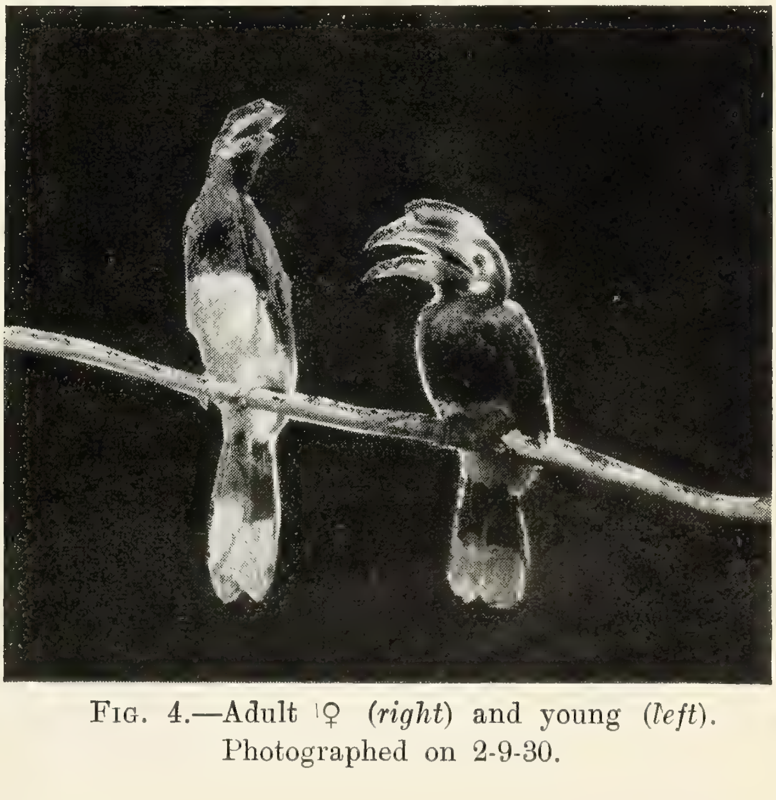


Fig. 4.—Adult ♀ (*right*) and young (*left*). Photographed on 2-9-30.

Fig. 3.—Young bird photographed on 12-8-30.

Indo-Burmese Pied Hornbill (*Hydrocicsa m. leucogaster*).

(*Copyright.*)

Photos by the author.

made to the taking of a young bird. Mr. D. S. Kaikini who presented it to the Society wrote that the mother bird was not in the nest when the youngster was found (an almost fully fledged ♀). She had left the nest before. The mother bird breaks down the wall of the nest for her own exit and then rebuilds it, leaving a narrow slit for the young bird to thrust out its bill. The nest wall has to be broken down again before the young one can be removed.

In the case of the Indo-Burmese Pied Hornbill—as reported by Mr. Gee—if we are correct in assuming that the nest wall had been broken, and the circumstances appear to indicate as much—the wall was not rebuilt, or the parent could not have re-entered the hole; and so the young bird was left exposed. Under the circumstances the presence of the parent in the nest at night would give the young one some protection at a time when it was most needed. This is a point which can only be cleared up by further observation. Information is needed as to:—

(1) The stage of development reached by the young of this hornbill when the parent leaves the nest.

(2) Whether the nest wall is rebuilt or not after the mother bird leaves the nest.

(3) Whether she returns to roost in the nest chamber at night.—Eds.].

XVII.—THE MIGRATION OF WILD FOWL.

THE SOCIETY'S BIRD RINGING SCHEME.

Since the publication of the last recoveries in vol. xxx. No 4 of the Journal, the following has been reported to us by the manager of the Birdringing Bureau, Moscow, U.S.S.R.

Place of ringing.	No	Date.	Species.	Ringed by.	Date recovered.	Locality.	Remarks.
Kambar, Sind.	3412	30-12-1929	Red-Crested Pochard.	H.A.L. French.	9-7-1932.	Lake Baikal, Siberia.	

Editors.

XVIII.—EARLY ARRIVAL OF SNIPE IN THE ANDAMANS.

On August 28th 1932 Mr. A. G. Bird and myself shot two couple of Pintail Snipe in some paddy fields about 7 miles S. W. of Port Blair. We saw about a dozen birds. The previous day I had put up some snipe in this spot. On looking through the Game Book of the Settlement Mess I find no record of birds shot earlier than September 3rd with the exception of an entry dated 28th August 1903. The birds were in excellent condition and very wild. The above may interest readers of the *B.N.H. Journal.*

PORT BLAIR,
ANDAMAN ISLANDS.
September 1, 1932.

J. MILES STAPYLTON, I.C.S.,
Deputy Commissioner, Andaman and Nicobar Islands.

XIX.—THE COMMON CENTRAL ASIAN KINGFISHER (*ALCEDO ATTHIS PALLASII REICHENB.*) IN NEPAL.

Mr. Stuart Baker in the *Fauna* Vol. iv, page 253, rightly assumes that the bird from Nepal will prove to be *pallasii.* In the Society's collection there are a couple of specimens from Nepal collected by Lt.-Col. Kennion which are beyond a doubt *A. a. pallasii.*

BOMBAY NATURAL HISTORY
SOCIETY, BOMBAY.
December 15, 1932.

V. S. LaPERSONNE,
Assistant Curator.

XX.—THE OCCURRENCE OF THE LESSER KESTREL (*CERCHNEIS NAUMANNI FLEISCH.*) IN BURMA

With reference to the note by Mr. J. K. Stanford published on page 265 of this volume.

This is the first record, so far as I am aware, of the Lesser Kestrel in Burma and it only shows what a great deal there is yet to be done by the men on the spot in ornithology in Burma. As may be gathered from the *Fauna*, Edition II, very little is known about this bird in British India at all. I have collected most of, if not all, the records and it will be seen that these are fragmentary and rather contradictory.

Kashmir. Seen once by Adams (Hume's Scrap Book, p. 105.)
Amballa. One examined by Hume. (l.c.)
Delhi. One shot by Tytler. (l.c.)
Lucknow. Three brought in by a shikari; as *pekinensis* (A. Anderson, S.F., III, p. 384).
Lucknow. One in British Museum (? one of above) race indeterminable (F.B.I., Edn., Vol. v, p. 66).

Dinapore. One in April (Brooks); in B. M. Race indeterminate (l.c.)

Ahmednagar. Two from a flock of 2 dozen in January; sent to America, race unknown. (Fairbank, S.F., IV, p. 252).

Deccan. Common in cold season. Davidson on January 4th in Sholapur District, saw flock of several hundred; none obtained. Apparently breeding Mahableshwar District in middle of May (Davidson and Wenden, S.F., vii, p. 73).

I have obtained *naumanni*, not *pekinensis* in the Deccan (McGregor, S.F., X, p. 435).

Nilgiris. Breeds in the cliffs (Jerdon's Birds of India, I., p. 40.)

Coonoor. One obtained by Carter (Hume's Scrap Book, p. 105.)

Dagshai. Commonest of the two Kestrels (Adams' 'Wanderings of a Naturalist in India', p. 99.)

Sikkim. One from Gammie in B.M.? *naumanni* (F.B.I., Edn. II, v., p. 66.)

Bengal. Not uncommon in the rainy season (Hume, quoting Blyth, Scrap Book, p. 105.)

Calcutta. Four specimens listed 1841-8 (Blyth's Catalogue, p. 16.)

Dibrugarh. Cripps met with six once in March and got two (Hume, S.F., XI, p.4.)

N. Manipur Hills. One examined by Hume (l.c.)

N. E. Cachar. Five seen and one obtained (J. Inglis, S.F., V, p. 5; type of *Tinnunculus inglisi*).

Naga Hills. Obtained by Godwin Austen (Hume, S.F., XL, p. 4.)

Of these records Adam's and Jerdon's are almost certainly erroneous. It will be seen that the question of dates and regularity of occurrence are quite unknown as well as the distribution in British India; neither is it certain whether both *naumanni* and *pekinensis* occur. It will also be noted that there are no recent records.

Mr. Stanford's two specimens are males of the previous year: one shows adult plumage on the head and mantle; in the other the adult plumage on these parts is not quite attained and moult is in progress.

I judge from the deeper colouration and spotless underparts that they belong to the eastern race *pekinensis*.

SAXON HOUSE,
APPLEDORE,
KENT.
September 20, 1932.

CLAUD B. TICEHURST.

XXI.—SOME OBSERVATIONS ON THE NESTING OF A PAIR OF CEYLON SHIKRA HAWKS (*ASTUR BADIUS BADIUS GMELIN.*).

The following observations were made in the garden at Hunugalla Bungalow, Elkaduwa (3,500 feet), when I was residing there, during 1928.

Early in March, a disturbance had been noticed on several days in and round two large *Tuna* trees growing together at the bottom of the lawn, in front of the bungalow, and before long it was quite evident that a pair of Shikras had chosen, or were considering, these trees as a site for their nest.

For several days the two birds were noticed repeatedly flying in and out among the branches, much chittering was heard, especially in the early mornings, and the birds were quite unusually excited. As the trees were some 50 yards only from the bungalow, observation was kept upon them from time to time from the bungalow windows.

Nest building.

On the morning of Sunday, March 10th, at about 7.30, the hen bird was observed to fly into the larger *Tuna*, from a nearby *Cassurina*, with a long twig in its talons. It was then ascertained that nest building had already commenced. She was seen to make her way into the centre of a clump of *Loranthus*, a mistleto-like parasite, towards the top of the tree and examination with field-glasses revealed that a few small twigs had been collected here and placed as a foundation for a nest.

The site selected appeared to be almost ideal—a fork, some 30 to 40 feet from the ground, in a large upstanding branch, reinforced by a knot and the stems of the *Loranthus* parasite.

The hen bird was now most enthusiastic over her building. No sooner was one twig in place than she flew back to the *Cassurina* for another. The twigs brought by her were apparently mostly dead or very nearly so; they were broken off by the hawk, herself, tugging at them with such force that, on several occasions, she fell backwards off her perch when the break came suddenly. Though broken off with her beak, most twigs were transferred to her talons, either before commencing the short flight back to the *Tuna* or else in mid-air, but one or two small twigs were carried the whole distance in her beak.

The greater number of the twigs used were those of the *Cassurina* but on one or two occasions she was observed to break off dead twigs from some of the close by clumps of *Loranthus*.

While the hen bird was showing so much enthusiasm over her building, the cock bird appeared to be rather bored. He generally remained somewhere in the vicinity and watched his mate at her labours, or he took a short fly round, returning after a few minutes to note her progress. Only on three or four occasions was he observed to deign to help her. Three times he was seen with a twig—a very small twig—in his beak. Once he found the hen bird at the nest when he arrived back in the tree, so he dropped his burden and flew away again. But on two other occasions he added his very small contribution to the slowly increasing pile.

It was noticed that, until the nest was nearing completion, only one bird would approach it at a time; if the hen bird was at it, the cock would not approach within yards, and if the cock bird was inspecting it, when the hen bird returned, she would wait for him to leave before approaching closely.

Building operations were, as far as I was able to observe, only carried on for about three hours during each morning; for the rest of the day the birds were generally somewhere in the vicinity but they did nothing to add to the structure.

The nest appeared to be completed on the eighth day. On Monday 18th, the hen bird was seen to add one or two small twigs, early in the morning, but they were merely finishing touches as, after that morning, she was not seen to bring in any further material.

MATING.

During the whole of the time that the nest building was in progress, mating continued intermittently. The act of mating was witnessed on several occasions and was heard taking place on many more; it was always accompanied by excitement and noise. The act was accomplished amidst much 'chittering' on the part of both birds and much flapping and fluttering of wings on the part of the male bird.

I am under the impression that mating was taking place on each of the three or four days during which the birds were creating so much noise and disturbance, prior to the commencement of nest building. But the first occasion on which I actually witnessed the act was on the afternoon of the day on which building commenced. It continued, intermittently, always accompanied by the same fuss and noise, until the completion of the nest. The last day on which I observed the act was the 19th, the day after the last day on which the hen bird was observed carrying nest materials. The act took place three or four times a day—but never during the time when nest building was actually in progress.

FEEDING.

On two occasions the male bird was seen to bring food for the use of his mate; once before the nest was completed and once afterwards. On each occasion he brought the food into the tree adjoining and called his mate from her nest, departing as soon as she appeared. I was unable to distinguish, with certainty, the food brought but it appeared to be a small bird and a lizard, respectively.

BEHAVIOUR OF OTHER BIRDS.

It was interesting to note what little notice the small birds of the immediate vicinity took of the two hawks, once they had got used to their presence. The hawks were decidedly noisy and were continually flying in and out of the *Tuna* trees, yet the small birds took extraordinary little notice of or interest in them. Occasionally they would utter a few alarm notes and become a little restless but generally they continued their search for their own food, among the other *Loranthus* clumps and seed clusters of the *Tuna* trees, with remarkably little concern.

One day I observed a White-eye (*Zosterops ceylonensis*) actually hopping about the foundations of the nest while the female hawk was within a yard of him—but apparently the hawk regarded this as impudence, for she flew at him and drove him away! Another time, a small bird, of uncertain species, was hopping about among the foliage within three feet of the hawk while she was pulling to pieces an offering from her mate.

On the morning of the 21st, the nest was visited and was found to contain three eggs, plain bluish white in colour with no markings. The nest was constructed entirely of twigs, with rather finer *Cassurina* twigs as a lining.

GAMMADUWA, W. W. A. PHILLIPS, F.Z.S., M.B.O.U.
CEYLON.
September 25, 1932.

XXII.—NESTING OF THE GREY PARTRIDGE (*FRANCOLINUS PONDICERIANUS GMEL.*)

I wish to report what to me is rather an unusual occurrence. On my return from home from three months' leave last month I found that a pair of Grey Partridge had taken up their abode in my bungalow in the middle of this camp. They always roosted in the same tree and the cockbird always piped his *reveille* about 5 a.m. Some days afterwards I missed the hen bird and thought that she must have been taken by a jackal, which abound here. However, my Sikh orderly found her later sitting on six eggs behind a small *Duranta* hedge, in the middle of some old hedge cuttings not 15 yards from where five horses remain picketed out till 10 p.m. The hen bird is quite tame and will, I trust, live to hatch out the eggs.

Isn't it strange?

(1) For Grey Partridges to lay so late in the season?

(2) To be so tame as to nest not 15 yards from a comparatively large stable where syces are coming and going all day?

I thought the above might be of interest as I have never seen a case like this in 26 years in India—not even in the jungles of Central India.

Delhi Cantonment, D. B. EDWARDS,
October 20, 1932. *Lt.-Col.*

[The Grey Partridge usually lives in patches of grass jungle between cultivated areas often in close proximity to villages. The present instance of a pair breeding in the heart of a populous Cantonment is unusual and interesting. The birds are very irregular breeders and the eggs have been taken in almost every month of the year. The bird usually has two breeding seasons; the first principally during March and April, the second during August and September.—Eds.].

XXIII.—THE OCCURRENCE OF THE GREEN PIT VIPER (*TRIMERESURUS GRAMINEUS*, SHAW) AT NAGPUR.

The other day a specimen of this Viper, caught under a water butt near the Cotton Market, was brought to me alive in a bottle. Its head not being visible, I concluded it was the common green snake *Macropisthodon plumbicolor* and was on the point of turning it out and seizing it with my hands, when the green colour, however, struck me as being rather vivid, and a closer look at its head revealed its identity. This is the first specimen I have seen at Nagpur. Wall says 'It does not occur in the plains of India, but affects an altitude of from 1,500 to 6,000 feet.' Nagpur is just below 1,000 feet.

Central Museum, E. A. D'ABREU, F.Z.S.
Nagpur.
August 18, 1932.

XXIV.—INTESTINAL PARASITES OF THE PYTHON.

A python which had seized and devoured a dog was recently shot near Kotagiri (Nilgiris) by a Mr. J. Beaver.

When the python was cut open, the stomach bag was found to hold the dog, a certain amount of saliva, and between three and four hundred red-brown worms about ¾ to 1 inch long and about 1/16 inch thick. The worms were crawling over the dog's body, and were also feeding on the lips, round the eyes, ears, and the soft parts of the underside. Except for the dog, and the worms, and a certain amount of saliva, the stomach bag was very clean. The python was shot three days after taking the dog.

Is the presence of these worms in pythons usual, and do they play a part in the python's digestive functions?

HONNAMETTI ESTATE, R. C. MORRIS, F.Z.S.
ATTIKAN P. O.,
Via MYSORE,
S. INDIA.
September 20, 1932.

[In the absence of specimens it is not possible to fix the identity of the worms. Various intestinal parasites have been found in pythons. A cestode or tape worm (*Bothridium pythonis*) is found in great numbers in the intestine. They are sometimes free and sometimes attached to the mucous membrane. Another cestode (*Solenophorus megacephalus*) also inhabits the intestine of this snake. A nematode or round worm (*Ascaris attenuata*) has also been discovered in the intestines. These intestinal parasites are most detrimental to the health of their hosts. Ferguson says that once all the pythons in one of the cages in the Trivandrum Garden died and a post mortem examination revealed that they were found to be infested with nematodes that had perforated the walls of the stomach and intestines.—EDS.].

XXV.—THE OCCURRENCE OF THE COMMON CHAMAELEON (*CHAMAELEON CALCARATUS*) IN GUJARAT.

On August 18th., I got a *Chamaeleon calcaratus*, caught two miles south of Ahmedabad, feeding on ground in long grass at the root of a Cactus hedge. This is noteworthy, as according to Boulenger (F.B.I., *Reptilia*, 232), the species is known to occur in 'wooded districts of peninsular India, south of the Gangetic plain and Ceylon'. Ahmedabad cannot boast of any woods though there are numerous trees in this place.

This is the second time the chamaeleon is found to occur in North Gujarat—the first being a specimen caught in 1926 by Prof. Sutaria of the Gujarat College, Biology Department, on the College grounds.

I may here mention that Nurse (*J.B.N.H.S.*, xiii, 337), while writing on lizards, among the animals he caught at Deesa, does not mention the occurrence of the Chamaeleon.

It is curious that people in this place—even the Vagharis, who are supposed to be past masters in animal lore, especially lizards (*Gho* in Gujarati)—know nothing about this innocent reptile, and it was after much schooling that my man was able to grasp what I wanted.

AHMEDABAD,
N. GUJARAT.
August 22, 1932.

HARI NARAYAN G. ACHARYA, F.Z.S.

[Mr. McCann of the Society secured a specimen of a Chamaeleon from the Abu Hills which was brought in by Bhils. The example survived captivity in the Society's office for over a year. In dry districts Chamaeleons are abroad during the rains, but appear to retire soon after the rains are over. Even in districts where they occur Chamaeleons are not too common.—EDS.].

XXVI.—A NOTE ON THE OCCURRENCE OF *RANA HEXADACTYLA*, LESSON IN BENGAL.

(*Published with the permission of the Superintendent, Zoological Survey of India.*)

While studying the Amphibian fauna of Bengal, I collected a species of frog, hitherto unrecorded from Bengal, from several ponds at Dhakuria near Calcutta. I have compared these specimens with those of *Rana hexadactyla* (Lesson) in the collection of the Zoological Survey of India and have no hesitation in assigning them to this species. My identification has also been confirmed by Dr. Malcolm Smith to whom three specimens were sent from my collection.[1]

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[1] Sir David Ezra sent a few specimens of this frog from Calcutta to the Zoological Gardens, London. Eventually they died there and were sent for identification to Dr. Malcolm Smith, who, from an examination of a mutilated specimen, tentatively thought that it might have been a northern race of *R. hexadactyla;* and he requested the Director of the Zoological Survey of India to send him a collection of this species. Fortunately at that time I possessed these frogs, and three specimens, two females and one male, were sent. In acknowledging the receipt he concluded in a letter 'they differ certainly in colour from the *R. hexadactyla* of Southern India but they must be referred to that species. It is interesting to find its range extended.'

Boulenger in his Fauna volume[1] and also lately in his monograph on the Asiatic species of the genus *Rana*[2] observes that among the secondary sexual characters only vocal sacs are present in this species, but it is interesting to record that the male specimens in my collection, besides possessing the vocal sacs, have the usual characteristics of the thumb pads which are better developed in the adult males than in *young* specimens. There is, however, no male specimen in the collection of the Zoological Survey of India with which comparison could be made. Dr. Malcolm Smith, however, informs me that there is only one adult male in the collection of the British Museum of Natural History, regarding which he notes 'it is from Madras and has the digital pads feebly marked. Being a sexual character this varies, becoming more evident in the breeding season.'

In habits it is purely aquatic and lives in association with frogs of the species *Rana cayanophlyctis*, Schneider. The ponds from which these frogs were collected had a luxuriant growth of vegetation. The leaf-green colour of the dorsum serves nicely the purpose of concealing the frogs in the dense aquatic vegetation of the ponds. The colouration of the living specimens, as noted by Annandale,[3] agrees well with all the specimens in my collection. The colour of the ventral parts, especially of the throat area, is golden-yellow. The ventral parts when viewed in sunlight show an iridiscent hue. I have further observed that when kept in a big jar with a little quantity of water the frogs gradually lose colour. The beautiful leaf-green colour is entirely lost when preserved in formalin or in spirit, and becomes a dark shining lead blue colour with ventral parts dusky white.

In regard to their food habits I cannot say anything in particular except that I induced them to feed upon earthworms after a few days' starvation in the Laboratory. I also tried to prove their cannibalistic nature, but failed, whereas Dr. Malcolm Smith informs me that the frogs living 'in the London Zoo fed freely upon other frogs and preferred them to other food.'

DISTRIBUTION.

According to Boulenger (*loc. cit.*) *Rana hexadactyla* is confined to Southern India and Ceylon. Annandale and Rao,[4] however, extended the range of distribution to Puri in Orissa from an examination of 'faded specimens of tadpoles'. Later on, in a footnote in Boulenger's monograph on Rana (*loc. cit.*, p. 12, 1920) Annandale corrected his previous joint observations and made the following remarks: 'The locality Puri given by Narayan Rao and myself (*Rec. Ind. Mus.*, xv, p. 31) is probably incorrect being based on somewhat faded specimens of tadpoles from running water

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[1] Boulenger, G. A., 'Reptilia and Batrachia', *Fauna of British India*, pp. 441-442 (1890).

[2] Boulenger, G. A., 'A Monograph on the South Asian, Melanesian and Australian Frogs of the genus *Rana*', *Rec. Ind. Mus.*, xx, pp. 11-13 (1920).

[3] *Rec. Ind. Mus.*, xx, p. 12 (1920).

[4] *Rec. Ind. Mus.*, xv, p. 31 (1918).

(see my notes on *R. cyanophlyctis*). On a recent tour through the eastern districts of the Madras Presidency I failed to find *R. hexadactyla* north of Nellore.'

Bhatia and Gulati,[1] in connection with their studies on the protozoon parasites of frogs and toads, have recorded the occurrence of *Rana hexadactyla* in Lahore, Punjab. They do not, however, say how many specimens they collected and examined. Taking their identification to be correct it may be said that their finding is very interesting in respect of the zoo-geographical range of the species, and it would be interesting to procure further specimens from the same or adjoining region for comparison and examination.

Undoubtedly *Rana hexadactyla* is a South Indian frog, as it is very commonly found in that area, but the occurrence of this species in Bengal (and also in North India) is interesting, especially in view of Annandale's above remark. Boulenger (*loc. cit.*, p. 3, 1920) is inclined to consider *Rana hexadactyla* of South India to be 'among Asiatic species the nearest approach to ideal prototype' and derives many species from it; it does not seem improbable that much light may be cast in regard to the derivation of other species from the Bengal form of *Rana hexadactyla*.

Through the courtesy of Dr. Baini Prashad the manuscript was sent to Dr. Malcolm Smith who very kindly read through my notes and made several interesting marginal comments, which I have made use of in rewriting the article. To both of them, I take this opportunity of acknowledging my grateful thanks.

INDIAN MUSEUM, J. L. BHADURI.
CALCUTTA.

XXVII.—FRESH WATER EELS.

On page 880 of your popular *Journal*, Vol. xxxv, No 4, of 15th July 1932, Dr. Johannes Schmidt of Copenhagen has asked for some information regarding freshwater eels north of Bombay and whether they are found in the river Indus. I have not been able to ascertain from the Karachi fishermen if they are to be had in the Indus, but I know for a positive fact that eels exist in the river Sabarmati at Ahmedabad, 300 miles north of Bombay, as I frequently caught them there as a lad in the sixties, the largest being about sixteen ounces in weight. At the same time I saw something which should be noted particularly, and that is the fact that in a very small and shallow pool of water away from the stream I saw a number of very small eel fry scarcely each an inch long. Now the question is, did these young fish come up all the way from Cambay, where the Sabarmati empties itself into the sea, or were they spawned and born in the portion of the river

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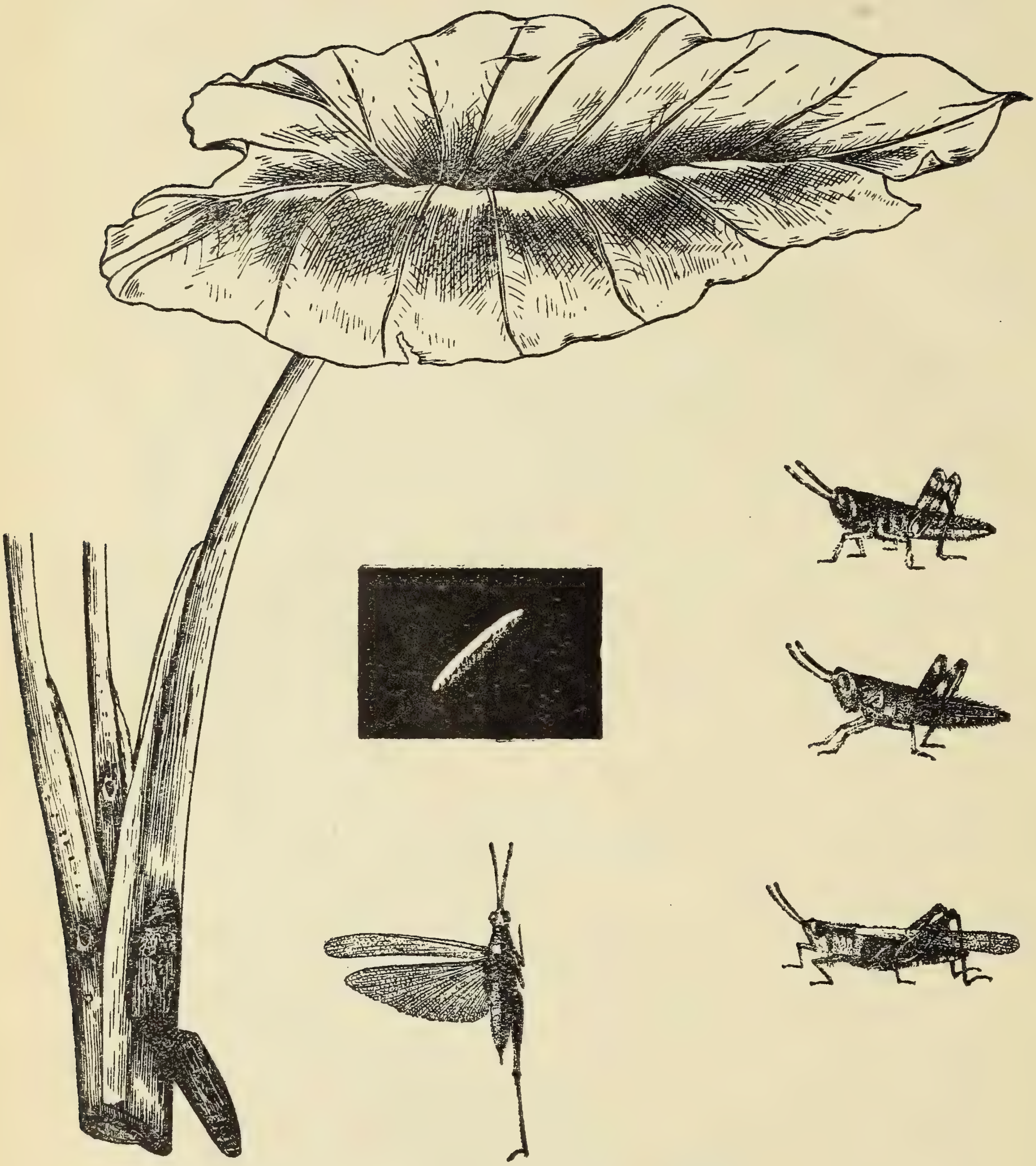
[1] Bhatia, B. L., and Gulati, A. N., 'On some parasitic ciliates from Indian frogs, toads, earthworms and cockroaches', *Archiv. f. Protistenkunde*, lvii, pp. 85-87 (1927).



Gesonia punctifrons, St. (Breeding in *Colocasia* stem).

1. *Colocasia* stem showing egg mass in stem.
2. Egg magnified.
3 & 4. Younger stages.
5 & 6. Adult.

at Ahmedabad? I am inclined to the latter belief as I am certain such small fry could not have travelled that distance. However, I am open to correction. I may add that I am not aware of the genus to which the Sabarmati eels belong. Will you kindly find a place for this article in your valuable Journal?

KARACHI. S. A. STRIP.
September 5, 1932.

[Mr. C. E. L. Gilbert, Conservator of Forests in Sind, has very kindly been instrumental in interesting officials in his department in discovering whether the Fresh Water Eels *Anguilla bicolor* or *bengalensis* occur in the river Indus. Two examples of fish collected by the officers of the department were recently forwarded to the Society but they both turned out to be specimens of *Mastacembelus armatus*, a common, somewhat eel-like, fish which occurs throughout India. We hope that readers of this Journal who are in a position to do so will help in elucidating this question, as to whether fresh water eels are found in the Indus and its tributaries.

If the fish Mr. Strip saw in the sixties at Ahmedabad were fresh water eels and not the eel-like fish *Mastacembelus armatus*, it is practically certain that the fry were not born in the river at Ahmedabad, that is, if the breeding habits of the Indian fresh-water eels are the same as the European.

Dr. Johannes Schmidt, whose classic discovery of the life history and breeding grounds of the European Fresh Water Eel is one of the romances of modern scientific research, will shortly contribute to this Journal an article, on the subject of Indian Fresh Water Eels relative to the problems he is now investigating. EDS.].

XXVIII.—NOTES ON AN *ACRIDIID* GRASSHOPPER (*GESONIA PUNCTIFRONS*, ST.) OVIPOSITING INTO STEM OF '*COLOCASIA*' PLANT.

(*With a plate*)

During the courses of investigation of the different species of grasshoppers found in wet land areas in the Central Agricultural Farm, Coimbatore, in August last, an acridiid grasshopper was noted among *Colocasia* (*Sémbu*) plants growing along the field bunds. A close examination of some of the plants revealed that the succulent stem in some of them was bored through and a cluster of eggs deposited inside the same. As far as the authors are aware grasshoppers of the group *Acridiidae* are generally known to deposit their eggs in the soil and this case appeared an interesting and curious one worth investigation. To confirm our suspicions as to whether the eggs were those of this grasshopper or not, some of these insects were bred in the Insectary and our conjecture was confirmed. The following notes on the breeding habits of the insect, which appear to exhibit a curious and not hitherto noted phenomenon are published with the idea that it may attract the attention of entomologists working on this group of insects and to invite their criticisms and suggestions, if any.

The adult female selects the succulent stem of the plant for oviposition. A round black hole of about 4 mm. in diameter from which a sort of gummy fluid exudes, marks the spot on the stem where the eggs are laid. It has been noted in captivity that the grasshopper tries the stem from top downwards and after a few trials finally inserts the tip of the abdomen into the fissure made in the stem and deposits the eggs into the thicker portion of the stem. When the portion of the stem showing such dark marks is gently cut open, the eggmass with 8 to 12 eggs embedded in a sort of yellowish white glutinous fluid can be found enclosed in the soft tissue of the stem. The eggs are creamy white, curved and elongate; and each measures about 2½ mm. in length. In each eggmass there were found from 8 to 12 eggs.

LIFE CYCLE.

The eggs collected from the field hatched in 9 days maximum and the nymphs on their hatching came out one by one through the hole made by the female hopper for egglaying. A newly hatched nymph measures about 5 mm. in length and is dark brown in colour with the body covered with scattered hairs. The antennae and legs are creamy white with black rings; the eyes are blue.

The nymphs undergo four moults within a period of 22 days at intervals of about a week.

Second stage nymph:—About 10 mm. long; brown in colour; antennae whitish with black stripes; legs also white tipped black; and three longitudinal stripes running along the mid dorsal line.

Third stage:—About 15 mm. long; colour pale brown; antennae and legs pale whitish; the central stripe has disappeared and the two lateral stripes are now represented by dots.

Fourth stage:—About 20 mm. long; no appreciable change is noted excepting that the projection of the wing pads is clearer and the blue dots on the back turning whitish yellow.

Fifth stage or adult:—After the 4th moult the nymphs attain the adult stage.

One adult collected from the field lived for about one month; but no eggs were laid in captivity under laboratory conditions.

It is possible that this habit of laying eggs inside the plant stem might have been adopted by this insect feeding on the *Colocasia* plant on account of the usually wet and damp nature of the soil in which this plant is generally found growing. One or two of the American acridians, like *Chloealtis* and *Paroxya*, have been occasionally noted to seek wood and other media for egg deposition rather than the soil.

COIMBATORE.
June 23, 1932.

T. V. RAMAKRISHNA AYYAR,
and N. KRISHNA MENON.

XXIX.—PHOSPHORESCENCE IN A BOMBAY MYRIAPODA.

The occurrence of this phenomenon in a centipede is not new to science. It has been observed in the members of the family *Geophillidae* as described in *The Cambridge Natural History*, Vol. V, p. 34, by Sinclair, F. G., M.A., formerly F. G. Heathcote), 'One of the strangest peculiarities found among Myriapods is that some of them (e.g., *Geophilus electricus*) are phosphorescent. As I was walking one summer evening near my home in Cambridgeshire I saw what I thought was a match burning. Looking more closely, I saw it move, and thinking it was a glow-worm I picked it up, and was surprised to find that it was a *Geophilus* shining with a brilliant phosphorescent light. I let it crawl on my hand, and it left a bright trail of light behind it which lasted sometime. I have been told that this species is common in Epping Forest; also in Cambridgeshire.'

'Besides *G. electricus*, *G. phosphoreus* has been described as a luminous species by Linnaeus on the authority of a Swedish sea Captain, who asserted that it dropped from the air, shining like a glow-worm, upon his ship when he was sailing in the Indian Ocean a hundred miles from land.'

'What the use of this phosphorescence may be is not known with any degree of certainty. It may be either a defence against enemies, or else a means of attracting the two sexes to one another.'

The centipede showing phosphorescence at Bombay also falls in the family *Geophillidae*. It is found in damp soil, and sometimes frequents human residences, particularly when it rains heavily outside. Apparently it is only a stray visitor to human houses, perhaps it takes shelter there from rain at times.

Unlike the phosphorescence of *G. electricus*, which is said to leave a trail behind it as it moves on, the present specimens do not leave a trail of phosphorescence behind them in the ordinary course of progression nor are bodily phosphorescent like a glow-worm. However, when one is killed, the body fluids wherever they get smeared show phosphorescence for a few moments if the surroundings are not strongly lighted. Sedgewick in his *Text Book of Zoology for Students* says (Vol. III, p. 597) that this phosphorescence is due to the excretion of a fluid from the sternal glands. This is in all likelihood true, because when the specimens are pressed with a pencil or a rod they show the luminescence at that spot of the pressure, which apparently causes excretion from the said glands. The observation on the crushed specimen can thus be explained, in two ways, (1) that the sternal gland fluid gets mixed all over and causes the phosphorescence and (2) that other body fluids such as the colourless blood may likewise be phosphorescent too. However, it was found difficult to isolate the phosphorescent effect of blood from the excretion of the sternal glands. Whatever may be the source of the phosphorescent fluid, blood or sternal excretion, the glowing fluid coagulates in a short while as a white patch, wherever it falls and does not remain phosphorescent after it is dried up.

A specimen of this Geophillid centipede kept in a tube under observation showed phosphorescent droplets at the ends of its fangs in the region of its head, showing that the fluid from the poison glands behind the fangs was also capable of giving a glow.

In this connection another interesting observation which has been casually reported to the writer, is that if on a living specimen methylated spirit be poured and burnt, it gives a phosphorescent glow for nearly fifteen minutes after the spirit has ceased to burn in a flame.

Both these observations, namely (1) phosphorescence from droplets of poison from the fangs, and (2) the glow in adverse circumstances like mechanical pressure, and subjection of the animal to the burning heat of a spirit flame, suggest that the phosphorescence is used by this centipede as a measure of defence, and to manifest its displeasure in a glowing frown 'writ large' on the whole of the body.

PUNJAB. A. N. GULATI, M.SC.
August 31, 1932.

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